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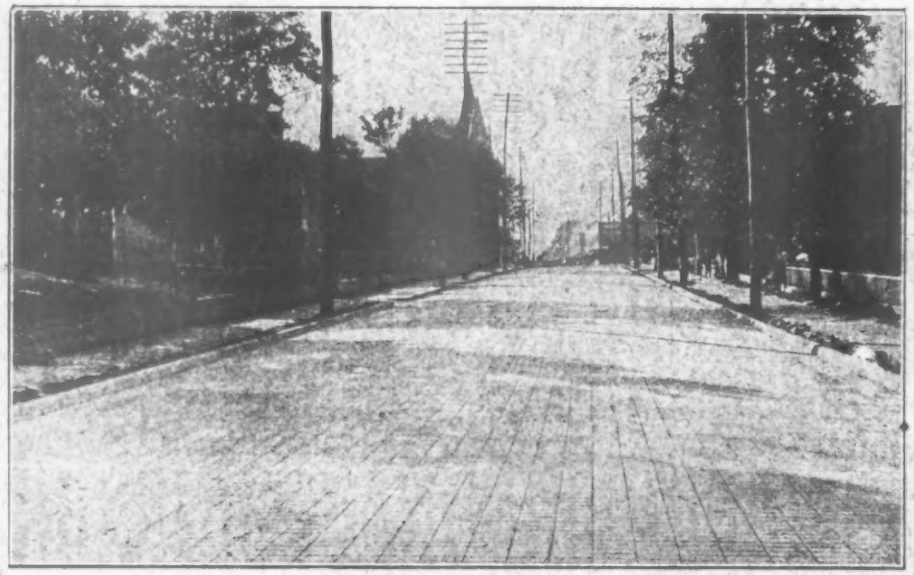

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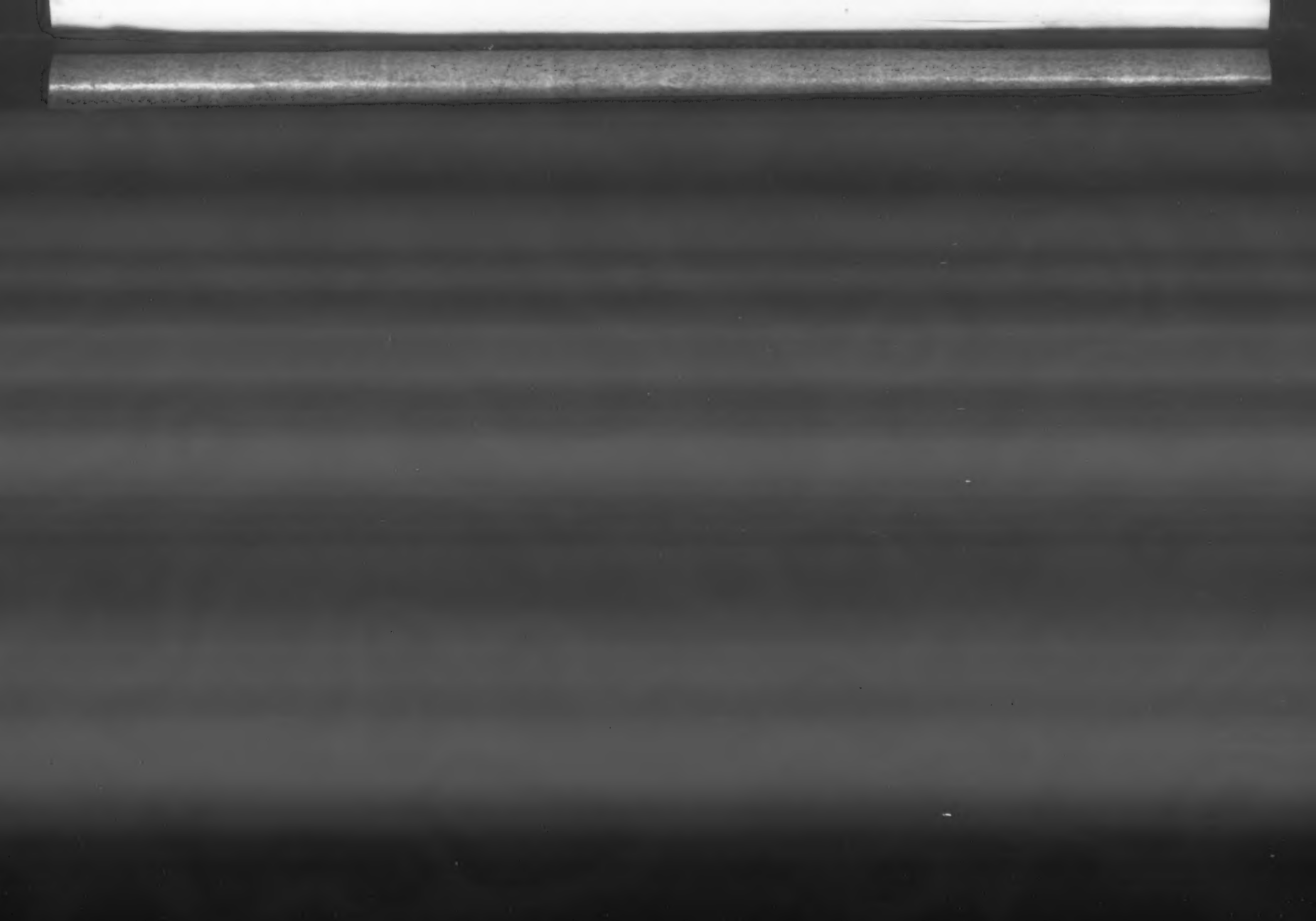

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MUNICIPAL ENGINEERING

VOLUME XXXVII. OCTOBER, NINETEEN HUNDRED NINE. NUMBER FOUR

CITY SHADE TREES.

THE story of last year's work as gathered from the fifth annual report of the Shade Tree Commission of East Orange, N. J., is one which may well serve as a model for other cities to follow in beginning the care of their own trees.

The commission acts under a law devised primarily for East Orange, but applicable to any New Jersey city so electing. The law has been adopted almost in its entirety by the State of Pennsylvania, and its provisions are followed as far as possible by park boards elsewhere. One essential feature of the law is the power of the commission to assess the cost of tree planting upon the property benefited. Another is the full power which it gives over the street trees. These are not ordinary provisions, and must be adopted by legislative action before they are applicable in any state.

The East Orange commission is composed of Alfred P. Boller, an eminent engineer, Edward M. Colie and Edward O. Stanley, all public-spirited citizens who serve without compensation. They have the confidence of the citizens and of the city council, and are given sums of money for their work in caring for the trees which are sufficient to show results, though probably not sufficient to do all the work that might be done. For the work in care of trees the board has the proceeds of tax ordinances, the returns from which for 1908 were $4,030. The cost of trees set out in 1908 was $2,758.75, which was raised by special assessment on the property benefited. The board also did work in its field outside the province of these two funds, the expense of which, $271.96, was paid by those for which it was performed. The board also had at its disposal $1,500 for the improvement of Elmwood Park.

William Solotaroff is the efficient secretary and superintendent of the commission and we are indebted to him for the accompanying photographs illustrating his work.

The plan of the commission to plant trees of the same kind on a street is shown by the table showing the distribution of the 728 trees planted during the year. European lindens to the number of 95 were planted on one street. Oriental planes were planted on two streets; Norway maples were planted and replanted on eight streets; pin oaks on one; red maples on three; white oaks on one; gingkos on one; sugar maples on eight, only one being new planting; red oaks on two. Plate I shows a street on which pin oaks were planted by the commission in April, 1905, the photograph bearing date of August, 1908. Plate II shows the pupils of Franklin school planting in the school yard on Arbor Day a gingko tree presented by the commission. It also shows some of the natural and artificial conditions which the commission can aid in keeping beautiful and extending to other sections of the city.

All newly planted trees are supplied with uniform wire guards made of No. 16 ½-inch mesh bent into cylindrical forms 6 feet high and 7 inches in diameter and well fastened together at the closure. To prevent chafing a piece of rubber hose is fastened on the inside of the guard at the top. Two chestnut stakes, each 2 by 2 inches in cross-section and 8 feet long, are driven to a depth of 2 feet, about a foot from two opposite sides of the base of the tree. The stakes are connected to the tree by ¼-inch sash cord on which is slipped a piece of rubber hose long enough to insure no rubbing of the tree by the cord. No. 12 fence wire fastened by staples to the stake did not serve the purpose as well as the cord, which remains fastened as long as the stakes are necessary. This apparatus is shown in

EAST ORANGE SHADE TREE COMMISSION.

I. Pin Oaks on Eppirt St., Three Years Old.

Plate III. The tree guards will be seen on the three-year-old trees shown in Plate I, but the stakes have been removed. The new trees were watered in July by means of a 210-gallon galvanized sheet-iron tank on an ordinary wagon. Of the new trees 94 were lost, five on account of a leaking gas main. They were paid for by the gas company. A mulching of manure was put round all the new trees in the fall.

The older trees received some attention in respect to fertilizing. The new trees on several streets were given a mixture of acid phosphate and muriate of potash in 1907, and the same trees were given nitrate of soda in March, 1908, at the rate of 300 pounds to the acre, dissolved in water and used at the rate of one-eighth pound to sixteen square feet around each tree. On a few streets manure was applied in the fall, an area of 8 by 4 feet around each tree being loosened up and the manure dug into the soil. Six other streets were treated to the phosphates, using 700 pounds of acid phosphate and 300 pounds of muriate of potash and applying the mixture at the rate of 1,500 pounds per acre.

During the life of the commission 2,446 trees have been set out, making 11.7 miles of uniformly planted streets. The whole area of the city has been covered by the process of pruning the older trees, and some of those pruned in 1904 have again come into turn for pruning. There are 42.4 miles of streets that have received this attention, 5.2 miles during the past year.

The treatment of trees for insect pests was quite extensive during the year. The only troublesome visitor was the elm beetle. The commission treated the street trees in the manner described in the following circular addressed to property owners, spraying the trees on a number of streets in June with arsenate of lead, and the lower parts of the trunks and bases of elms on other streets, reached later, with kerosene emulsion, four times at intervals of about a week. As there are about 900 large elms in the city streets, and the most effective spraying must be done within about three weeks in June, plenty of apparatus and men would be necessary for the best results. The circular referred to was issued March 10, 1909, to property owners having elm trees on their private property, and reads as follows:

Last year the attack of the elm trees by the elm leaf beetle was general throughout the city. The shade tree commission is making extensive preparations to spray all the elm trees on the streets as soon as the foliage develops in early May. To destroy the pest most thoroughly, it is important that the citizens given attention to elm trees on their grounds which are outside of the jurisdiction of the shade tree commission.

The winter of the elm leaf bettle is passed in the adult condition, the beetles taking shelter in attics, sheds, barns and other places. They emerge from their hibernating quarters as soon as the foliage of the elm develops in the spring, take to the leaves and eat holes through them. (See A, Plate IV.) During the latter part of May and early June eggs are deposited by the beetles on the under side of the leaves (C, Plate IV), from which tiny caterpillars hatch. They feed on the layer of cells of the under sides of the leaves, giving the foliage a skeletonized appearance. (B, Plate IV.)

Beginning during the last days of June and continuing until the middle of July, the full grown larvae, which are less than half an inch long, crawl down the trunk and change to yellow pupae at the base of the tree and on the ground near it. Adults develop about a week after the formation of the pupae, and in the latter part of July the summer brood of beetles is abundant. These fly to the leaves again, feed on them, deposit eggs, and the life cycle of the insect is repeated. There are two broods a year.

The only effective way to control the elm leaf bettle is to spray the foliage with arsenate of lead as soon as the leaves unfold. This spraying is important, because if the beetles can be killed before they lay their eggs there will be no larvae to deal with later.

It is this early spraying to catch the adult beetles that the shade tree commission is planning to do, and it is expected that all the elms along the curb will be treated. To spray elm trees properly, so that the tops of the trees are reached, requires a powerful apparatus, which every citizen cannot be expected to have.

The shade tree commission has therefore decided to accommodate property owners and spray such elm trees on their private property as can be reached from the street or from a driveway, when the general spraying of the other trees is done. A charge of $2 per tree will be made, which must be paid to the receiver of taxes in advance.

EAST ORANGE SHADE TREE COMMISSION.

II. Franklin School Children on Arbor Day.

If early spraying is neglected, an application of arsenate of lead is necessary when the larvae begin to feed. This spraying is not as effective as the early spraying. When the full-grown larvae crawl down the trunks to pupate, great numbers of them collect in the crevices of the bark at the bases of the elms and on the ground near the trees. At that time every owner of a tree can do his part to destroy the pest by sweeping up the caterpillars as they came down, and kill them by pouring hot water over them.

The commission's apparatus for spraying trees is shown in Plate V.

The tussock moth, so troublesome in other eastern cities, has given but little trouble. The egg masses of the insect, shown in Plate VI, remain on the trunks of the trees all winter, and should be taken off before they hatch. In March a few clusters, all that could be found, were picked off of trees on two streets and burned. Later the caterpillars were found on six other streets, and further destruction of the eggs followed. The woolly maple scale was found on a few sugar maples, and they were washed with kerosene emulsion to kill the larvae and insects in cocoons. Webs of the fall web worm were cut out and burned on five streets.

ASPHALT PAVING MIXTURES.

By L. Kirschbraun, Municipal Asphalt Laboratory, Chicago, Ill.

DURING the last thirty years in which sheet asphalt pavements have been extensively laid in this country, it is estimated that over 50,000,000 yards have been laid at a cost to American municipalities of approximately $125,000,000. During this period there has probably been no form of public works contracting which has been enshrouded in as much mysticism and concerning which public officials knew so little and fought so many bitter battles. Millions of dollars were expended without the least knowledge of whether taxpayers would receive full value therefor, and with slight exception it has been only within the last few years that public officials have begun to awaken to the necessity of some intelligent check and inspection of asphalt paving construction.

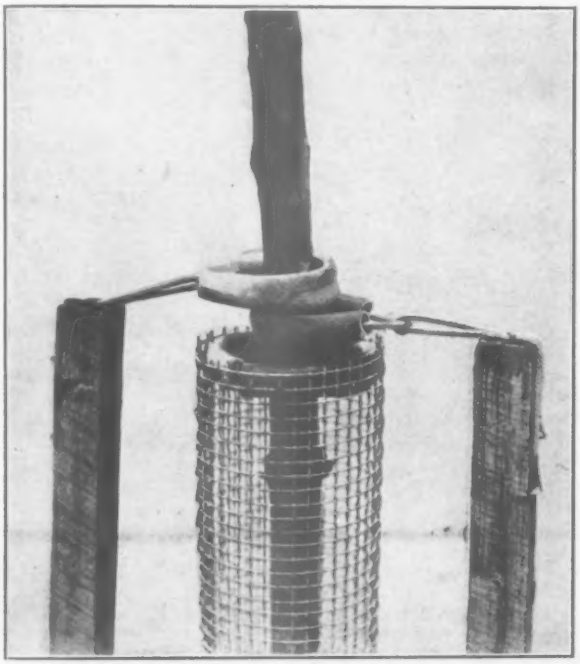
In the early days of the industry good and bad pavements were constructed. It was no uncommon occurrence for the same contractor to lay an excellent pavement on one street and a poor one on the very next. This was not due to any inferiority of the materials available, but to lack of knowledge as to how they should be mixed. With the advent of the open specification, which broke the monopoly held by Trinidad asphalt, there resulted a development of other asphalts, both natural and artificial, until in recent years there has in some local instances been too much competition. The market has been flooded with poorly prepared or insufficiently tested asphalts and asphaltic mixtures, producing inferior pavements through the efforts to use such in reducing the cost. It is to guard against conditions thus outlined, and to protect itself against inferiority in so important a matter as pavement, that the larger municipalities now require a system of asphalt inspection competent to discern between good and poor paving materials, and able to insure the proper preparation of the asphalt mixture.

Asphalt pavements as now constructed consist of three courses—a foundation of hydraulic cement concrete on a well-compacted sub-grade, an intermediate binder course, and the top or wearing surface, each course varying in thickness in different localities and for different conditions of traffic. It is assumed that the reader is familiar with the general mechanical processes involved in the preparation of these courses.

Engineers do not yet realize sufficiently the importance of a rigid and dense base for asphalt pavement. It has been the experience of the writer that fully 50 per cent. of the failures of asphalt on heavy traffic streets result from an insufficiency of the base, either in the matter of rigidity or in permitting the destructive action of water on the under side of the asphalt covering. Asphalt is the most exacting pavement in foundation requirements, and it is as rational to build a skyscraper on a weak foundation as to lay an asphalt pavement on an insufficient base. Even rigidity in the base is insufficient where the character of the

subsoil is such as to subject the concrete base to continued moisture, and it is only by a proper system of subdrainage connected to sewer inlets that a pavement can be insured from this destructive element. It is, however, the province of the engineer to provide this basic element, and for the purposes of this discussion it may be assumed that suitable base has been provided for.

The asphalt is the most important of these materials. As the cementing element, the life of the pavement is limited by the life and properties of the asphalt which binds its particles together. The differentiation of good from inferior asphalt has been the source of much controversy, but with the strides which have in recent years been made in technology of the asphalt industry, it is possible for one experienced in the testing and in touch with the practical results obtained with successful asphalts to make such differentiation with sufficient certainty.



EAST ORANGE SHADE TREE COMMISSION.
III. Guard and Stakes for Newly Planted Tree.

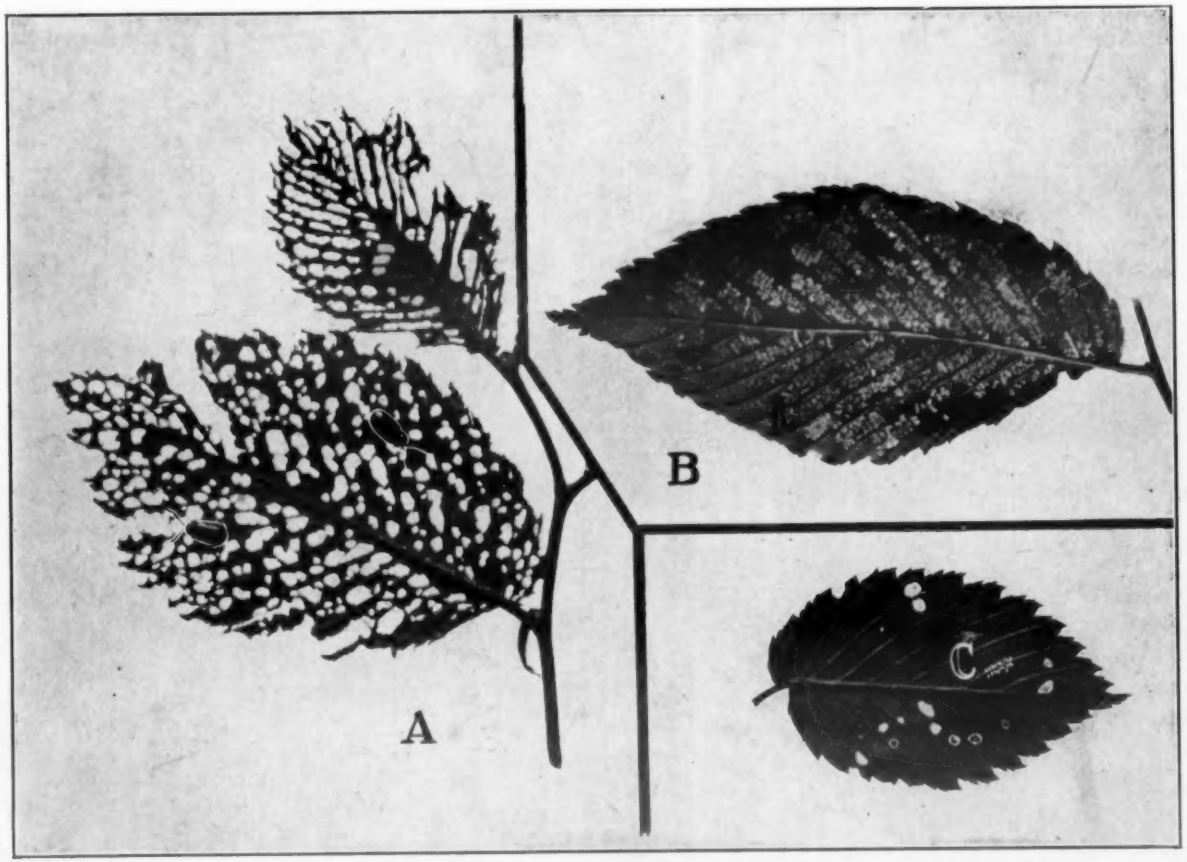
The essential requirement of an inspection system in a large city is a laboratory where chemical and physical tests can be conducted upon the various materials used, and upon the mixtures produced each day. This should be in charge of an asphalt specialist, and with him should be provided trained inspectors for each plant whose duties will be made evident from the discussion following.

To produce a durable pavement it is necessary, first, that the material entering its composition be of good quality; second, that proper skill in proportioning and handling such material be employed. The first requisite brings us to the discussion of the chemical and physical characteristics of materials of the desired quality.

Asphalts in use at present are of great variety, and the kinds met with in any particular locality depend upon conditions of transportation, specifications and other local factors. For the purpose of treatment in this discussion, paving bitumens may be classified into three groups according to nature and origin:

I. Natural asphalts, occurring as such in nature and refined merely by removal of water, light oils and grosser mineral impurities.

II. Combinations in which hard natural asphalts, containing less than 60 per cent. of their bitumens soluble in



EAST ORANGE SHADE TREE COMMISSION.

IV. Elm Leaf Beetle at Work. A. Adult Beetle. B. Caterpillars. C. Eggs.

standard naphtha, are refined or must be used with the addition of predominating amounts of asphaltic oils or residues incorporated by blowing and agitation.

III. Solid residues produced by the distillation or oxidation of petroleums.

Asphalts of the first class, which are at present of commercial importance—as examples, Trinidad and Bermudez—have demonstrated by long use their fitness for paving purposes. The nature of their bitumens is uniform, their chemical and physical characteristics are well recognized, and their proper method of handling well established through successful use.

Asphalts of the second class have only in recent years become of commercial importance through the development of the asphaltic oils. While as a rule they have not been used sufficiently long under known conditions to have demonstrated long durability, nevertheless for the period in which they have been used they have proven satisfactory when properly handled, and give every indication of ultimate satisfaction. On account of their nature and manner of combination, they require close scrutiny, and, in using, call for considerable skill on the part of the plant foreman. Their use should be regulated according to condition of inspection, traffic, and the skill and reliability of the parties producing and using them.

Bitumens of the third division are from their present manner of production and marketing uncertain for general use. Some are good and some are bad. Many result as a by-product in the refining of crude oils, and are produced under such severe conditions as to become seriously injured. California oil residues, when carefully and specially prepared for the purpose, are excellent paving materials. The commercial article, however, varies greatly in quality, consistency, and in the conditions of preparation, and their use should be attended by the closest scrutiny. No doubt the time will come when, with more careful and uniform methods of preparation, these California residues will be worthy of the recognition to which, when so prepared, they are entitled. Semi-asphaltic and paraffine oil residues, as now prepared, should not be used as the principal part of an asphalt cement.

The differentiation of good from poor asphalt is to a great extent a matter of judgment, requiring the interpretation of analytical data by one experienced both in the laboratory testing and in the practical usage of the various paving bitumens. The physical appearance of a good mixture made up of a given asphalt, and its behavior in the various stages of producing and laying the pavement, afford to the experienced operator valuable indication as to the quality of the asphalt. There are, however, a few well-defined characteristics which good asphalts possess. These may be roughly stated as follows:

(a) They do not contain more than 3 per cent. of their bitumens insoluble in cold carbon tetrachloride.

(b) Their bitumens do not yield on ignition more than 18 per cent. of fixed carbon.

(c) Their bitumens consist of 60 per cent. of malthenes, *i. e.*, material soluble in standard petroleum ether. When less than this amount of malthenes is present the asphalt should never be used without an asphaltic flux.

(d) When fluxed into an asphalt cement of the consistency used, it should not lose over 5 per cent. of material on heating for seven hours at 325 degrees F., nor should its consistency decrease by more than 60 per cent. of the original consistency.

(e) The penetration when fluxed into an asphalt cement should not be less than 10 at 32 degrees F., nor more than 350 points at 115 degrees F., when tested according to a definite standard.

(f) When combined with the flux as an asphalt cement, it should not contain more than 3 per cent. of paraffine scale.

When interpreting the data obtained in test "d," it is necessary to take into consideration the relationship between the loss of consistency and the amount of material volatilized. When both factors are comparatively large, the loss of consistency is due greatly to volatilization, but when the amount volatilized is small, a large loss of consistency indicates oxidation or change of molecular structure. A satisfactory asphalt cement will also exhibit in its finished mixture malleability, ductility, body and life, qualities for which no satisfactory tests have as yet been devised, but which to an asphalt expert are definite and well recognized characteristics.

Fluxes now in general use are the residues of paraffine, semi-asphaltic and California asphaltic petroleums. They are as a rule well prepared, and ordinarily they can be easily differentiated by their densities. A good quality of flux must be sufficiently stable as not to lose more than 5 per cent. of material by volatilization when heated at 325 degrees F., and it should be so

EAST ORANGE SHADE TREE COMMISSION.

V. Spraying Apparatus at Work on Elm Tree.

free of light oils as not to flash below 350 degrees F. It should show no indications of rapid hardening or pitching when exposed to 400 degrees F. for a period of seven hours.

The filler commonly used is ground limestone, though various other inorganic powders have been used at times. For work exposed to trying conditions Portland cement has been demonstrated to be of superior efficiency. The quality demanded of filler is that of extreme fineness, and fillers are ordinarily required to be so finely divided that 75 per cent. shall pass a 200 mesh per linear inch sieve. There is a great range of fineness, however, even in material passing a 200 mesh sieve. The most valuable part of a filler is the extremely fine material, which can only be determined by elutriation methods. Such filler as is now sometimes prepared by blowing previously ground limestone in order to separate and collect the finer particles is immeasurably superior to that prepared by grinding only.

The desirable properties of the stone used in the binder course are that it should be clean, well graded, and so hard as not to crush under the roller. The sand should likewise be clean and well graded, as will be discussed later, and the particles should be hard and not too round. The relative hardness of various sands has not been sufficiently investigated as yet, and is a matter of more importance than is commonly supposed.—*The Michigan Technic.*

PROGRESS ON THE PANAMA CANAL.

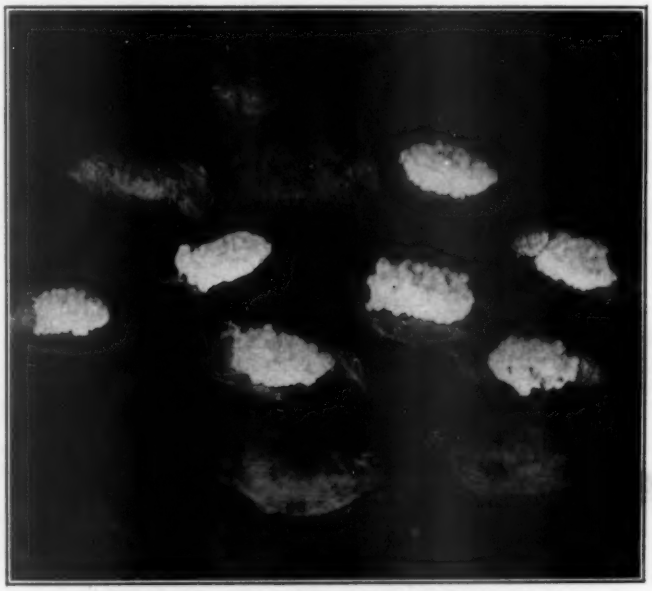
By Dr. Edward P. Bailey, Los Angeles, Cal.

ONE of the first and most vivid impressions received on the inspecton of the canal is the spirit of American enterprise, push and activity that is manifest everywhere, transforming a sleepy, half-dead region into a scene of the busiest and most bustling display of energy. The spirit of progress seems to be in the air, and can be felt the moment one lands, that lively American spirit of efficiency, good organization, economy and enterprise.

The Panama canal is the largest work in progress in the world to-day, and Uncle Sam has laid off his coat and tackled the job with a full appreciation of its magnitude and a determination to finish it in a hurry. The fact is that over 60 per cent. of the entire digging has been accomplished already, and the excavation can easily be finished inside of four years. In the year 1908 the amount of earth removed was over 37,000,000 cubic yards, or an average of over 3,000,000 yards per month, and this year the material removed should exceed 40,000,000 cubic yards, which is as much as the French moved in fifteen or twenty years of their greatest activity. At the beginning of 1909 the amount of material remaining to be moved was about 104,500,000 cubic yards, and by the end of the current year, at the present rate of progress, there should be less than 65,000,000 cubic yards remaining. It may be possible to get this completed before the end of 1912, which would only require a rate of working of one-half the present rate after this year is over. For this reason it seems that the estimate of the time of opening the canal on January 1, 1915, is quite within reach, provided no epidemic occurs to demoralize the force. This would leave two years after all the excavation is finished to complete the locks and all the extras.

From deep water in the Atlantic to deep water in the Pacific the total distance along the canal route is 50 miles, of which 42 miles is from shore to shore, and 8 miles is in the ocean (3 miles at the Atlantic end and 5 miles at the Pacific end), where dredging from 0 to 45 feet must be done. The Panama canal is being made much larger than it was originally intended to be—wider and deeper—and it will be very much larger than the Suez or any other ship canal in the world. For 40 miles, or 80 per cent. of its length, it will be from 500 to 1,000 feet wide on the bottom. Two miles will be occupied by double sets of locks, while 8 miles, the portion covered by the Culebra cut through the backbone of the continent, will have a minimum bottom width of 300 feet. The minimum depth throughout will be 45 feet. The French planned to build a canal 72 feet wide and 29.50 feet deep, which would have been practically obsolete by this time, and of little service to-day had it been completed.

In all the years of their operations they accomplished the removal of about 85,000,000 cubic yards, of which about 40,000,000 cubic yards can be utilized for the canal now being constructed. Much of their work was easy digging in soft ground, and they did not do very much hard rock excavation, such as the Americans are doing. However, one cannot but marvel that they were able to accomplish as much as they did, considering the handicaps they struggled against. Modern science had not then discovered the way to master yellow fever and combat malaria by destroying the mosquitoes.



EAST ORANGE SHADE TREE COMMISSION.

VI. Egg Masses and Cocoons of Tussock Moth.

One of the striking features of the American regime is the miracle of sanitation that has been accomplished by Colonel Gorgas and his staff. They have transformed the Canal Zone from a region reeking with disease and death into a beautiful park, cleared of its jungle, drained of its swamps, with its mosquitoes practically exterminated and yellow fever stamped out. The isthmus has now become a rival of Southern California as an attractive winter resort. A part of this work has been the building of water works, street pavements and sewers for Colon, Panama, and all the principal intermediate towns in the Zone—and this item alone of water works, pavements and sewers has cost in all $8,000,000 already to accomplish, and will cost $12,000,000 more before it is finished, but it is worth all it has cost, for it has made the building of the canal safe and feasible, and the Canal Zone an enjoyable place of residence.

This is the secret of success, as it is the only way in which an efficient staff of laborers, foremen, skilled mechanics and engineers can be held together. It is certain that in no public work, or in any contractor's camp, was there ever so much done for the comfort of the employes. The men are well paid, well housed, well fed, and well cared for in case of sickness or accident. Houses, furniture, fuel, water, drainage, telephone and lights are furnished to employes without cost. Roads are built, schools supported, club houses and Y. M. C. A. buildings provided, and part of the running expenses paid. All the premises of the employes' dwellings are cleared and drained, and the grass around them kept cut short. All the houses are built with broad verandahs, enclosed with the most expensive and durable bronze wire screens, so that all the people can practically live out of doors, exempt from insect attacks. Bachelor quarters and hotels furnishing meals at low cost are provided by the government; hospitals of the most

modern equipment are also provided, with free medical attendance to employes and at low rates to families. A splendid band of music is also maintained free for the entertainment of employes, and this band is playing at some of the club houses every afternoon and evening.

Six weeks' leave of absence each year with full pay is given to all monthly employes, including mechanics, and much free transportation is given. Altogether, the canal employes may be regarded as a favored and pampered class, although they are demonstrating that this treatment is not lost upon them by the way in which they "make good."

On April 1 there were 33,000 men working on the canal and Panama Railroad, of whom about 25,000 are Jamaican or other West Indian negroes. About 5,000 are Europeans, mostly Spaniards, and the remainder are Americans and other nationalities. To supply these people with food and clothing Uncle Sam is running what you may call an immense department store, or commissary, with branches at all camps, where cash sales are prohibited, but everything is charged, and to employes only. The business amounts to nearly $5,000,000 every year. He is also running a big laundry, a huge bakery, and an immense ice-making plant, all of the products of which are supplied at a little more than cost.

Practically all food comes from the United States, the fresh meats, butter and fruits in cold storage, and the other substantials in the holds of every steamer plying between New York or New Orleans and the isthmus. Major Wilson, the commissary, expressed the greatest regret that they are unable as yet to secure a line of steamers direct from Southern California, which would enable fresh vegetables and fruits to be supplied all through the year, but hoped this might soon be established. Through the commissary department Uncle Sam conducts 14 hotels and 55 messes and kitchens scattered along the entire line of the canal. At the hotels the canal employes can get a good, wholesome dinner for 30 cents, as good as the average 50-cent meal in country hotels in this country—soup, fish, meat, vegetables, ice cream, cake and coffee. At the messes provided for the Spanish and Italian laborers the rate charged for board is but 40 cents per day, and at the kitchen where most of the negroes eat the cost to them is but 30 cents per day.

It may be of interest to know that Uncle Sam has to buy about 4,500,000 pounds of meat per annum to feed his Panama canal people, besides half a ton of chickens every day and 1,230 dozen eggs daily. The daily consumption of butter is 800 pounds, of potatoes 6½ tons, besides 2,000 pounds of ham, a ton of bacon, 75 sheep, and 500 gallons of fresh milk in bottles from New York. Every month they use 4,500 cases of condensed milk and 500 gallons of oysters. The bakery turns out 60,000 loaves of bread a day and 1,000 pies, and the folks eat ice cream at the rate of 400 gallons a day. The consumption of quinine last year averaged 211 pounds per month.

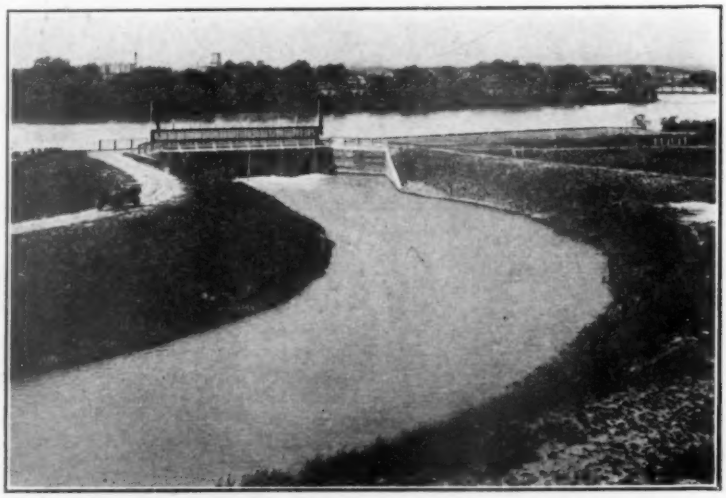
To house his employes and his machinery Uncle Sam has a total of 3,338 buildings on the isthmus, of which the French turned over more than 2,000, many of which are being used after having been renovated, whitewashed, and provided with screens and modern plumbing. Many of these old French buildings had to be located by map, as they had become overgrown and hidden by ten years' growth of tropical vegetation. It was not more than a year ago that a completely equipped machine shop was discovered in the jungle at Caimito, and found to be so serviceable that it has been put to good use. Many of the French machines are excellent and equal to anything Americans have taken down there, but the bulk of their equipment appears to have been trash, ridiculously inadequate and unfit for the work, and evidently purchased and sent out to the isthmus as a part of the awful system of graft, which was really one of the chief causes of the failure of the old French company. Wherever you go you see this machinery piled up in the jungle, or lying in the swamps, rusting and rotting away. It is depressing to see such waste, and one wishes it were all shipped to the United States, cut up and remelted.

The difference between the American way of doing things and that of the French is shown by the comparison of maximum achievements of each. The most that the French ever took out of Culebra cut in any one month is said to have been but 282,500 cubic yards, with a force of 16,000 to 18,000 laborers, while in the month of March last the huge American steam shovels removed 2,325,000 cubic yards, with a total force employed of less than that of the French, while the total yardage moved was 4,002,000 cubic yards, including dredging. In fact, the French appear to have had a small conception of the work, and they worked with small tools in a small way. Much of

the material taken from the cut was deposited on top so near the edge that there have since been considerable slides from these dumps back into the canal, which have had to be removed again.

SOME ENGINEERING FEATURES OF THE CANADIAN PACIFIC IRRIGATION PROJECT.

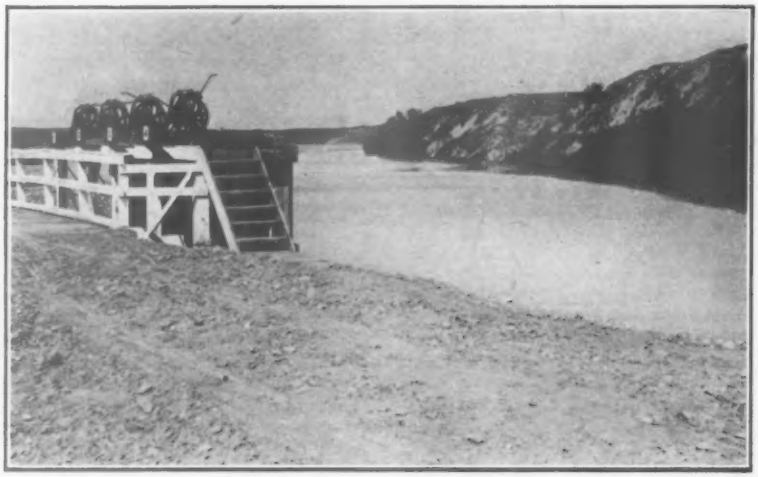
THE Canadian Pacific Railroad in developing the irrigation project upon its lands in Southern Alberta, a general descripton of which was given in MUNICIPAL ENGINEERING, vol. xxxvii, p. 161, has not found it necessary to consider the rainfall in the district in fixing the capacity of the drainage canals, except so far as the occurrence of rainfall during the growing season reduces the amount of irrigation water which it is necessary to apply to the land. all but three of which the annual rainfall was less than 20 inches, the average annual rainfall was 15.08 inches, of which amount 11 inches fell during the irrigation season, so that the total amount of water applicable to the soil was nearly 3½ feet of depth over the whole area during the irrigation season. The minimum rainfall during the irrigation season since records have been kept was 5.73 inches, so that the minimum application of water to irrigated lands would be practically 3 feet



CANADIAN PACIFIC IRRIGATION SYSTEM.

I. Head Works for Main Canal A on Bow River at Calgary.

The duty of irrigation water is fixed by the Canadian law, which provides that the amount to be supplied during the irrigation season, May 1 to November 1, must be one cubic foot per second of continuous flow for each 150 acres which it is proposed to irrigate. This is equivalent to about 2½ acre feet a year, applied during the irrigation season. During the seventeen years from 1885 to 1901, inclusive, in of depth. This is in excess of the actual needs of any crops grown on these lands. For the ten years ending with 1906 the average annual rainfall was 20.47 inches, and the minimum falling in any year during the six months of the irrigation season was 9.74 inches, showing a considerable excess over already large allowances during the present cycle of years of ample rainfall. In fact, the irrigation system at this



CANADIAN PACIFIC IRRIGATION SYSTEM.

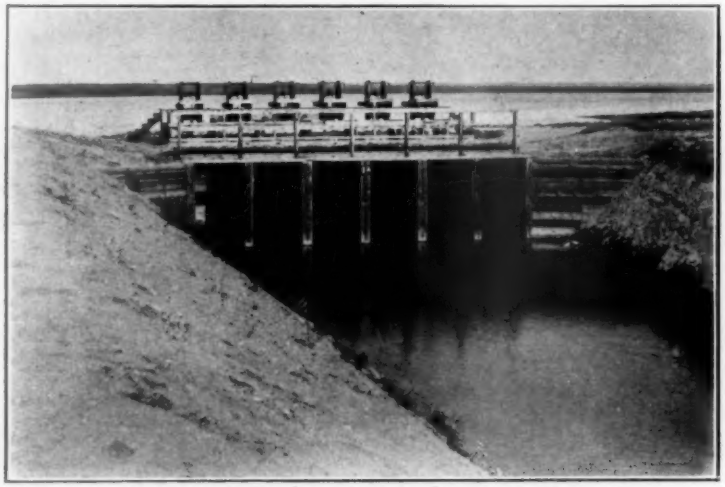
II. Spillway No. 2, on Main Canal A.

CANADIAN PACIFIC IRRIGATION SYSTEM.

III. Balancing Reservoir No. 1, at End of Main Canal A, and Head of Secondary Canals A, B and C.

time is a measure of crop insurance rather than the necessity which it may become during dry years.

The Bow river, from which the supply of irrigation water is drawn, gets its supply from the melting snows of the Rocky Mountains to the west and north, and therefore is ordinarily at its highest stage in June and July, rising rapidly from a low stage, the rise beginning soon after April 20. The lowest stage recorded during five years of the government investigations, 1897 to 1901, showed a gauge height of about 3.2 feet, and a gauge reading of 7.5 feet



CANADIAN PACIFIC IRRIGATION SYSTEM.

IV. Headgates Controlling Secondary Canal A.

is frequently exceeded in the period between May 20 and August 20, which gradually diminishes to about 4 feet November 1. It will be possible for some years to supply all the water required for the main ditch, leaving the river at Calgary, wthout a dam or any works except the gates shown in Plate I.

The head-gates there shown consist of 20 openings, each 3 feet in width and 10 feet high, and subject to top and side contractions. The total capacity of the canal, 2,000 cubic feet a second, when running 10 feet deep, can be passed by the gates when the river stands 10.25 feet deep on the sill. It will be noted that in the photograph but three gates are open, each not more than 2 feet. The entire structure is of wood, ease of construction, cheapness of material, low first cost and ease of modification being the main factors in determining the choice. It has been decided that a large part of the central district will be served from this canal, which has been constructed for the western district, this plan proving to be more satisfactory upon close study than that formerly adopted of procuring a supply directly from the river at a lower point. This will require an enlargement of the canal and of the head-gates. A dam to give constantly the full head on the gates is also determined upon. The new construction will probably be of concrete, because there are now two new cement mills within a few miles of Calgary, and others are under construction, and sand and gravel are to be obtained within reasonable distances, mainly from the bed of the river.

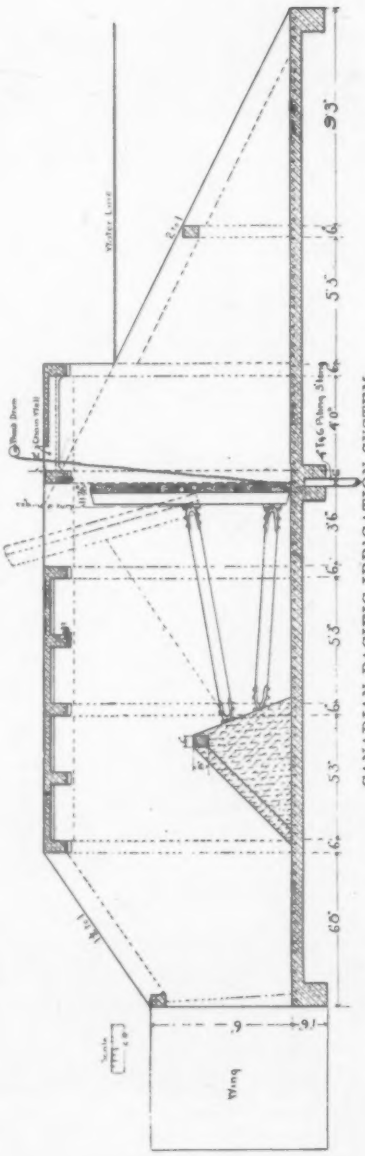
The standard cross-sections of the main canal shown in the photograph are 44 feet bed width, 10 feet depth of water running full, and side slopes 2 horizontal to 1 vertical. The fall is 0.02 feet per hundred. This canal follows the steep bluff near the bank of the river for some miles until it reaches a break in the bluff low enough to permit passage over into the country sloping to the eastward. The character of the bluff, and of the artificial canal bank on the river side, are shown in Plate II, which also shows spillway No. 2, which helps to keep the water in the canal at the standard level; these

gates are also in a wooden structure, and give 4 openings each 5 feet in the clear. This main canal is 17 miles long and discharges into the balancing reservoir, No. 1, which is formed by building a dam across a slough and filling the natural depression with water to a depth sufficient to give good service to the territory east and north through secondary canals. Plate III is a photograph of this reservoir taken at the entrance of the main canal at its south end. The reservoir is about 3 miles long, a half mile wide and 40 feet deep. The 50-foot dam forming this lake is the only important structure in the western section, the destruction of which would interfere with the supply of water in any material degree. As a consequence this dam has been made very strong, and has been thoroughly safeguarded.

From the reservoir there extends to the east secondary canal A, the headgates for which, near the south end of the lake, are shown in Plate IV. This canal is 18 feet wide on the bottom, carries 8 feet depth of water when running full capacity, and has 1½ to 1 side slopes at the point shown.

The gates shown in the photograph are 7 feet 3 inches wide and 8 feet high, and in the case of gates from this secondary canal to its principal branches the water will overflow the closed gates when more than 8 feet deep in the secondary canal, thus relieving that canal. Each gate is hung on four hinged arms, two on each side. These arms are hinged at proper points on sloping braces some 10 feet back of the gates. The winches seen in the pictures draw on chains attached to the gates, thus lifting them, the arms as they revolve throwing the gates clear of their seats and up out of the water. When the gates are lowered their weight and the pressure of the water on the inclined surfaces bring them to their places, the hinged arms always serving as braces. Slots for flash boards are provided in the gate frames some 5 feet in front of each gate, so that the water can be shut off independently in case the gates need repair.

Plate V shows a sectional elevation of a reinforced concrete gate chamber and wooden gate to draw water from the main or secondary canal where the side slopes are 2 to 1 into a branch canal with a width on bottom of 10 feet. The gate is similar to that described above, and is shown closed, the position of gate and arms when open being shown by dotted lines.



V. Sectional Elevation of Gate at Head of Branch of Secondary Canal A. Reinforced Concrete Gate Chamber.
CANADIAN PACIFIC IRRIGATION SYSTEM.

Plate VI shows secondary canal A just completed and before the adjacent land had been cultivated, in a section where the bed width is 22 feet, the water is 6 feet deep and the side slopes are 2 to 1.

This secondary canal A is 39 miles long, and then divides into the north branch 24 miles long and the south branch 33 miles to a second branching into two canals 22 and 25 miles long. This makes 143 miles of secondary canal A and its main branches, from which many miles of service canals are drawn, and thence many more miles of ditches to distribute the water measured from the canals over the farms. The longest run of water through this secondary canal A to the end of the farthest service canal is about 110 miles.

From the north end of the balancing reservoir runs secondary canal B to the east, from which, within a mile, runs secondary canal C to the north. Each of these canals has two branches. The north branch of B will have a branch to serve a large portion of the central section, and this canal will be enlarged to carry the additional water necessary for this service. The total length of secondary canals A, B and C is 150 miles, and the total length of the distributing ditches is 800 miles. Adding the 17 miles of the main canal, this makes 967 miles of canals and ditches in the western section, all served from the head-gates shown in Plate I. There will also be several hundred miles of small distributing ditches constructed by the farmers to distribute the water over their lands. The map in the September number on page 163 shows the location of the main and secondary canals and of their main branches.

The excavation of the main canal required the moving of 2,500,000 cubic yards of earth, or nearly 150,000 cubic yards per mile; the secondary canals, A, B and C, 5,000,000 cubic yards, or over 30,000 cubic yards per mile, and the distributing ditches 750,000 acres, or about 900 cubic yards per mile. The cross-sections of the various canals very according to the requirements, the smallest service ditches for sections or quarter sections of land being 2.5 feet bed with and 1 foot depth of water.

CANADIAN PACIFIC IRRIGATION SYSTEM.

VI. Completed Bed of Secondary Canal A, Before Admission of Water and Beginning of Irrigation.

EARLY HISTORY OF SEWERS OF MEMPHIS, TENN.

By A. T. Bell, C. E., Memphis, Tenn.

THE citizens of Memphis, Tenn, support a paper devoted to municipal matters, known as *Civic Affairs*. A recent number contains the following interesting account of the design and construction of the sewer system by an engineer conversant with the facts from long connection with the work:

The city of Memphis, situated on the east bank of the Mississippi river, midway between the Gulf of Mexico and the great lakes of the North, on a high plateau known to early settlers as the "Fourth Chickasaw Bluff," occupies a prominent commercial position as the entrepot of the great Yazoo Delta, to the south, with its 7,000 square miles of fertile alluvium, and the equally fertile St. Francis Valley to the west, with 4,500 square miles of choice agricultural land. Its superior business position for the past eighty years has been generally recognized and dwelt upon.

The site of the town is below the mouth of Wolf river, a stream navigable for some miles above its mouth; and above Nonconnah, a large but unnavigable stream, entering the Mississippi river five miles below. The lands to the north and south of these streams are of the lowland type, known as the bottoms of the Mississippi Valley. To the east of the city the high bluff formation of mulatto soil extends to the Tennessee river valley, one hundred miles away.

The city was laid out in 1826 and incorporated in 1827. The bluff on which it stands has an average elevation of 47½ feet above high-water mark of the Mississippi river, which has a fall of 39.85 feet to extreme low water. The drainage is from south to north through Bayou Gayoso, which, with several auxiliary branches, has its source in the southeastern portion of the city, and runs in a northwesterly direction through the geographical center of old Memphis, emptying into Wolf river just above its confluence with the Mississippi. The length of the bayou inside the corporate limits is approximately fifteen miles. Its fall is sufficient to afford perfect surface drainage, all of which passes through this channel into Wolf river. But surface drainage and other natural health conditions were inadequate to good sanitation, for as the old city grew in population its soil became polluted from decomposed animal and vegetable impurities and constant underground seepage from the contents of sewers, vaults, cesspools, etc., into cisterns, the water of which was largely used by its people at that time.

In making excavations for sewers in certain portions of the city in 1880 the writer found the soil so thoroughly polluted that it was necessary to spread lime in the trenches to prevent the laborers from being asphyxiated. Under such conditions our people were drinking water from seepy cisterns sunk beneath the surface.

During the summer of 1873 more than 2,000 persons succumbed to the ravages of yellow fever. This was the first serious demand made upon the city of Memphis for better sanitary conditions. After this a board of health was organized and decisive health ordinances adopted and enforced. These proved inadequate, for, in 1878 and 1879, yellow fever again visited the city and spread a pall of gloom as black as midnight over the entire vicinity.

In 1878 more than 15,000 people were stricken with the scourge, resulting in 5,150 deaths. Of this number 4,250 were white and 900 colored. In 1879 more care from a sanitary standpoint had been observed. A rigid quarantine was enforced; but notwithstanding that the city has been largely depopulated and that many who remained were immune, there were, according to the Howard Association records, 1,515 cases of fever and 485 deaths.

During the epidemics of 1878-79 fully two-thirds of the population left the city, many died from the fever in other places, and others never returned. For three months during each year business was wholly suspended, and all ingress and egress to the city was forbidden except for necessary purposes. The prostration of business left Memphis almost hopelessly bankrupt. And as a means of relief the legislature of the state, on January 31, 1879, repealed the city's charter and assumed exclusive control of its taxation and finances, constituted the city a taxing district, and placed its government in the hands of a legislative council. Also, in extra session, December, 1879, it authorized a tax levy of 2 per cent. on all taxable property within the territorial limits of the extinct corporation, and an addi-

tional privilege tax for and during the year of 1880 of 50 per cent., or an increase of one-half, for the purpose of constructing sewers, subsoil drains, etc. This tax of 2 per cent., of $2 on the $100 of valuation, was based upon the assessment of 1879, and was payable one-half in February and one-half in December of 1880. The total amount levied under this act amounted to $368,702.06. (Act passed December 27, 1879.)

Since that time the city has established a sanitary and sewerage system which is without a parallel. It has thus regained its prosperity, and is now one of the healtiest cities in the United States.

The ravages of yellow fever in 1878-79, with its appalling death list, not only aroused the people of Memphis to the necessity of prompt and vigorous action for better sanitary conditions, but it became a matter of national concern. It was the direct influence which brought the National Board of Health into existence. This body, through a committee, sent Col. George E. Waring, an eminent sanitary engineer of Newport, R. I., to this city, and caused a thorough inspection and sanitary survey of the whole area to be made during the winter and spring of 1878. After this survey it recommended a complete abolition of privy vaults, cesspools and improperly constructed underground drains, and the substitution of a thorough system of sewers and subsoil drain pipes.

The system recommended by Colonel Waring was purely theoretical. It had never been put into execution upon an extensive scale, and probably never would have been but for the great need and the inability of the people of Memphis to construct a more expensive system. The following is a description of the system as furnished by George E. Waring, Jr.:

"The unit of the system is a sewer of vitrified pipe six inches in diameter, with tight joints, laid in the streets (or in the alley between two streets where said alley exists), having at its upper end a 'Rogers-Field flush tank' with a discharging capacity of 112 gallons. All the houses on both sides of the sewer are connected with it by 4-inch pipes of the same material.

"The house connection drains enter the sewer at an acute angle and by a funnel-shaped branch pipe, which delivers the house waste at the bottom of the sewer, and which ventilates it at the top. The house connection drain has no top, and is continued by an untrapped soil pipe 4 inches in diameter, which continues above the roof of the house. Therefore, every house connection furnishes free ventilation to the sewer. The water closets, sinks and other vessels in the houses are separated from the soil pipe and ventilate each by its own trap. The flush tank is fed by a constant small stream from the water works, only sufficient to fill it about once in every 24 hours. When full the continuance of the small stream causes its automatic siphon to come into action, and the entire contents of the tank is discharged directly into the head of the sewer in from 36 to 40 seconds. The rapid discharge of such a volume flushes the sewer completely. At the lower end of the sewer, near its junction with the river, there is a fresh air inlet to supply the upward draught through the soil pipes of the houses. The 6-inch sewer, after receiving not to exceed 300 house drains, discharges into a main or sub-main sewer of 8 inches in diameter, or more, and the sub-main discharges into the larger main. The sizes of the sub-mains and mains are 8-inch, 10-inch, 12-inch, 15-inch and 20-inch diameters. The greatest flow is about nine inches deep. Porous subsoil tile drains are laid in the same trench with the sewer to under drain the ground, and these discharge directly into the bayou."

The special features of the system recommended by Colonel Waring are, first, "the use of pipe so small that the stream sent through them will flush them continually."

Second, "the exclusion of storm water."

Third, "the substitution of regular automatic flushing for rain or hand flushing."

This system was criticised very severely by many of the best citizens of Memphis; also by quite a number of prominent sanitary engineers; *i. e.*, the principal objections were the size of the pipe—from 6 to 20 inches in diameter. It was an innovation on all recognized systems. It had never been tried; it was an experiment, etc.

The legislative council of the city of Memphis adopted this plan, and on January 20, 1880, Colonel Waring, with eighteen assistant engineers, began active operations. On November 30 of that year 24.2 miles of sewer had been completed at a cost of $174,210.60. Two and one-tenth miles of private sewers were purchased at a cost of $8,875.42. The total sewers in use at the close of the year were 26.3 miles; total cost, $183,086.02, or a cost of $7,200 per mile. The cost of engineering for the above was $22,525, or $931 per mile.

During the years of 1881-82 10.3 miles of new sewers were constructed, and two miles of old sewers were purchased. The report of City Engineer Niles Meriwether for 1881-82 shows the obstructions for the two years of sewer action to have been altogether in the 4 and 6-inch laterals—a total of 75 in number. The cost of removing same was $1,112. He further said: "The system has grown so rapidly and now covers so much territory on the east and west sides of Bayou Gayoso that the main lines are at times quite taxed to their full capacity, showing that they will in time have to be enlarged at certain points."

This clearly indicates that the areas of the main sewers were insufficient; that the time had already arrived when a relief main must be constructed.

The beginning of the construction of the Monroe street relief sewer was practically the end of the Waring system as originally designed and constructed. It will be observed from the description of the system as defined by Colonel Waring that it was conspicuous for its small area in mains and laterals, its 4-inch house connections extending from main, or lateral, to property line; its curvature in change of alignment; its absence of manholes and the use of lamp shafts, built vertically from the sewer to within about two feet of the surface of the street or alley, with 6-inch pipes, capped with a stopper. These were observation holes to assist in locating stoppages. The laying of the sewer down hill, or from location of flush-tank to outfall.

The lack of area in the main sewers was developed in two years, when it was discovered that at the time of maximum flow the east and west mains were overcharged.

During the years 1884-85 these mains were taxed to such an extent that it was absolutely necessary to tap them at various points between Vance and Auction streets and turn the excess sewerage into Bayou Gayoso. This necessity of converting Bayou Gayoso into an open sewer, which was in itself a serious menace to the public health, was the direct leverage which brought into existence the Monroe street relief sewer. The completion of this relief sewer enabled the city to close all taps or bleeders flowing into the bayou north of Monroe street, but not until the completion of the 36-inch Huling street main (built in 1898) was it possible to close the bleeders south of Monroe street. This was effected by cutting off the west main at Elliott street and turning it into the Huling street main.

From 1892 to 1897, inclusive, 11.44 miles of sewers were constructed, and at the close of 1897 the city was in possession of 64.67 miles of sewers, ranging in diameter from 6 to 20 inches, except the Monroe relief sewer, which was 24 inches in diameter. Many manholes had also been added to the sewers built during the years 1880 and 1881, all of which cost $460,889.19. The cost of cleaning the sewers and removing stoppages, etc., for the same period was $62,816.87, making a total cost to the city for sewers and maintenance at the close of 1897, $523,706.06.

Fifty-four cases of yellow fever and fifteen deaths occurred in the unsewered district of South Memphis during the fall of 1897. This was the direct cause which prompted ex-Mayor W. L. Clapp to order the construction of the Huling street main sewer, the sub-mains and laterals of which were intended to sewer the territory in South Memphis, embracing an area of about 2,000 acres. Two hundred and fifty feet of this sewer was completed before the close of 1897.

The Huling street sewer enjoys the distinction of having perhaps the greatest depth—70 feet—of any sewer in the world. About 1,800 feet of this sewer was tunneled with shafts 50 feet apart, except after having laid about 100 feet through an open cut from the outfall, which rests upon a mattress put in by the United States government. A tunnel 150 feet long was cut into the bluff through running sand, and 36-inch iron pipe laid on a grade of 16.73 feet to 100 feet. The first 60 feet of this sewer was finished November 15, 1897, under the supervision of Mr. Jas. H. Elliott. The writer then took charge of the sewers and has had the supervision of the same to date.

The tunnel through the bluff had to be braced heavily on both sides, bottom and top, and notwithstanding that headers were driven from 10 to 16 feet in advance of the timbering in the tunnel on line of roof, even then at times the sand came in from the front in such quantities as to render it dangerous to the workmen. The timbering was put in in sections of 12 inches, as a rule, but occasionally, on account of the running sand, only 4 inches could be put in at a time. The balance of the work was done under usual conditions.

The Auction street 48-inch brick and iron sewer was commenced October

15 and finished about December 20, 1898. Length of sewer, 5,821 feet; average depth, 16 feet. The outlet of this sewer is on piling in Wolf river, at the foot of Auction street. The first 134 feet is laid at the rate of 14.46 feet to 100. This sewer was laid through an open cut, the walls of which had to be solidly sheeted on account of the water and the rotten soil through which it passed, the maximum depth being 25 feet.

The extension of the Auction street sewer with 36-inch vitrified pipe from Manassas street to Atkinson avenue was both tedious and expensive, more than 2,000 feet of which was laid at a depth of from 30 to 40 feet. The greater part of this line was tunneled. The shafts, tunnels and open cuts had to be sheathed with from 3 to 4-inch sheeting, the earth being so full of water that false roofing was necessary to carry off the seepage water as it trickled through the supporting roof of the tunnel.

At a depth of 36 feet at the first shaft east of Brinkley avenue one thrust of a workman's spade uncovered a spring, which flowed with such volume and rapidity that it filled the shaft (8x8) to a depth of 19 feet in less than two hours. The shaft was then abandoned, and the opening was reached and the water allowed to pass through the sewer. The flow of water from this spring proved to be so strong and continuous, that it became necessary to build a manhole at this point, and pass the water from the spring through an 8-inch pipe into the sewer. Recent observations show that this spring is running with the same force and volume as on the day it was uncovered, in December, 1900. The balance of the work was finished under average conditions.

The following table shows mileage and cost of sewers from 1880 to 1901, inclusive:

Year.	No. of Miles of Sewers Built.	No of Manholes Built.	No. of Flush-Tanks Built.	Cost of Maintenance per mile per year.	Percentage of Total Cost for Engineering Purposes.	Total Cost of Sewers.
1880	26.30	4	124	.....	0.123	$183,086.02
1880 to 1882.....	12.30	32	61	$16.81	0.077	79,050.14
1882 to 1884.....	2.30	12	7	33.26	0.143	21,595.75
1884 to 1886.....	2.58	19	6	73.58	0.063	40,666.44
1886 to 1888.....	2.19	19	10	48.77	0.079	32,794.91
1888 to 1890.....	3.63	155	24	111.57	0.071	37,884.28
1890 to 1892.....	5.30	237	35	127.46	0.033	47,245.82
1893	1.88	115	9	97.83	0.108	16,557.89
1894	0.68	47	7	96.75	0.155	11,610.10
1895	2.00	61	7	66.81	0.108	16,613.40
1896	3.28	60	28	67.90	0.090	19,921.71
1897	2.23	45	5	58.52	0.108	16,679.60
1898	19.03	112	56	37.70	0.022	170,192.03
1899	36.57	394	47	37.26	0.022	155,166.88
1900	21.54	200	59	28.44	0.032	106,352.04
1901	29.00	254	45	18.70	0.027	124,532.09
Totals	170.81	1,756	530			$1,079,949.10

DUST ABATEMENT BY SURFACE APPLICATIONS.

By W. H. Fulweiler, Philadelphia, Pa.

IN an exhaustive paper on "The Development of Modern Road Surfaces," before the Franklin Institute, W. H. Fulweiler has the following discussion of the methods which have been developed for treating road surfaces by moistening or tarring to prevent the dust rising:

While the use of water sprinkling has been almost the universal method for controlling the dust on broken stone roads, it has many disadvantages.

In the first place, it is only applicable to cities, parks and suburbs, where there is an ample water supply at the roadside. The action of the water is of very short duration, depending on the humidity, temperature and velocity of wind. This necessitates putting on a greater quantity of water than would otherwise be desirable in order to secure a more lasting effect. So that immediately after the application the surface of the road is softened and becomes muddy; in this condition the action of the motor traffic is particularly destructive. This mud dries out after twenty to thirty minutes, and for from one to three hours, depending on the atmospheric conditions, the road will be free from both mud and dust. However, as the evaporation continues, the surface again becomes dry and dusty, when the operation must be repeated.

The sprinkling given the road is usually more adapted to the money allotted than to the requirements of the road. In many cities they do not commence to sprinkle before June, and stop at the end of September. Thus the roads are unprotected from the high winds of the spring and fall, that do a great deal of damage to the surface, as it is then more or less loosened by the winter frosts or the usually more intense traffic of the summer months. In these places two applications a day, one about ten in the morning and the other at three in the afternoon, are used, thus giving a fairly dustless road through six to eight of the busiest hours of the day, or about half of our usual living day. In many of our parks, however, where more money is available, especially in Boston and the vicinity, where they sprinkle throughout the year whenever the dust flies and the thermometer is above 34 degrees F., this results in a sprinkling season of over 200 days, and requires on some days as high as six trips of the cart.

This excessive amount of surface moisture cannot fail to have a destructive effect on the bonding value of the road metal, as it is an intensified action of the usual atmospheric agencies that are credited with about 30 per cent. of the annual deterioration, the action of the horses' hoofs 45 per cent., and the wheels 25 per cent., for ordinary light-tired vehicles.

Under any conditions, unless night sprinkling were resorted to, we could only expect to keep the roads dustless by sprinkling about twelve hours out of the twenty-four, so that watering may be dismissed as of but little value at the present time.

Use of Hygroscopic Salts.—The rapid evaporation of water from the surface of the road, and its fugitive value as a dust layer, has led to attempts to retain the moisture in the road by the use of deliquescent or hygroscopic salts, which would abstract moisture from the air. The use of sea water was probably the first attempt to make use of this principle, but its hygroscopic action is quite feeble, and the resulting salts had a very destructive and corrosive action on the hoofs of horses, the varnish of carriages, pedestrians' shoes, and on all metal surfaces with which they might come into contact, so that while spasmodic attempts have been made to utilize it, they have all been abandoned. In order to find a neutral substance that would have the desired characteristics, experiments were made as early as 1828 with calcium chloride, which has since been quite extensively used for this purpose.

Several patented preparations have lately come on the market, such as aconia, a secret compound; lyminite, a mixture made by fusing $NaNO_3$, NaCl and CaO, and dissolving in water; panscale, the residue from brine evaporators, and Fitzsimmons' patent dust layer, a sodium silicate. These patented preparations seem to be no more efficient than the calcium chloride, and are considerably more expensive. The general method is to apply at the beginning of the season two strong coatings, about a week apart, using about .25 pound of chloride per square yard,

and then continuing with weaker solutions of about 0.1 of a pound per square yard at intervals of three to five weeks, as the atmospheric conditions require. In England the practice seems to tend toward the use of more salt with fewer applications, using up to three per season. They usually estimate that sprinkling with plain water is required from one to two times per week between the salt applications. It is necessary, however, after very hard rains, to immediately apply the salt solution again, as owing to its being very soluble it is all washed from the road. Although the calcium chloride has no specific bonding value, yet its use is immediately apparent on the road surface. The surface becomes darker in color from the moisture and iron in the salts, and appears of a very close and compact texture, due to the surface retaining all dust and thus sealing the voids. Raveling is prevented to a considerable extent, and what little dust may be lifted seems to be very heavy, so that it drops back almost immediately, so that in general we may say that its use is beneficial to the road.

The above observations apply to roads that do not support a very heavy traffic, as under the latter conditions it does not seem as effective. Owing to the fact that it is practically colorless, odorless and of a neutral reaction, it is particularly adapted for quiet residential streets, and for promenades where foot traffic is important.

The Calcite Process Company, of Boston, have developed a method for using this material that seems very effective and economical, and they undertake to render streets and roads dustless by contract for a fixed rate per square yard per season.

Emulsions.—The use of emulsions of oil and tar should properly be considered after treating of these agents as surface treatments, as emulsions were designed to obviate several disadvantages from their use, such as the necessity of preparing the road surface, heating the components, labor of spreading and the necessity of closing the road to travel during the application. Yet their use and application is so closely related to the former paragraph on hygroscopic salts that it was thought well to treat of them together. They were first developed about 1903 and 1904 in France and Germany, and the market was soon flooded with patented preparations with fantastic names, all claiming marvelous dust-laying properties. In general, they are an emulsion of tar or tar oils, asphaltic petroleum, asphalt, or, in some cases, of waste oily products made with soda or ammonia, and are expected to be diluted with water and applied to a road surface without previous treatment, from an ordinary sprinkling cart. The following is a list of the more important, and what information we have concerning them:

LIST OF EMULSIONS.

Apokonia—Product of heating heavy residual oil with phenols.

Apulvite—Powdered asphalt with emulsinifier.

Basilite.

Bouharol Process—Coal tar and soap.

Cook's Emulsion—This is a general process of emulsifying asphaltic base oils with a soap solution. A formula which is widely used is as follows: 8 bbls. of asphalt base oil, emulsified with 18 pounds cottonseed oil soap; made up to 600 gals. Mixed for use with three parts of water.

Crempoid R.—Glue, bichromate of potash, oil, tar.

Crempoid D.—Glue, bichromate of potash, oil, no tar.

Dustabato System.

Dustoline—Thin yellow oil, no body.

Dustroyd—Wool grease emulsified.

Ermenite—Cottonseed oil treated with H_2SO_4 at an elevated temperature, washed, mixed with 4 parts by weight of tar, emulsified with hot NaOH, diluted with water to contain 20 per cent. of tar. For use this stock solution is diluted with 4 parts of water.

Emulsifix—Tar mechanically emulsified with water.

Hahnite—Carbolic acid and oil emulsifying tar and asphalt at 150 deg. F.

Injectoline—A non-freezing oil.

Odocreol—A tar oil.

Newstrans.

Possiderite.

Posissierol.

Pulvicide—50 gal. creosote oil, 112 lbs. pitch, 252 lbs. resin, melted and mixed with solution of 28 lbs. NaOH in 18 gals. of water. Diluted with 10 times its bulk of water for sprinkling. Lasts about ten days.

Pulvivore—Shale oil from Autun, France.

Pulverento—Tar oil, mineral oil, carbolic acid, emulsified with ammonia.

Rapidite—Powdered asphalt mixed with emulsifier.

Ripley's Comp.

Sandisize—Grease from wool scouring, emulsified with potash, patented U. S. 813,389, Feb. 20, 1906.

Simplicite—Costs 4 cents a pound.

Sulphite Pitch—This is a by-product in the manufacture of sulphite cellulose.

It is soluble per se in water, and is said to have given very good results. This appears to be the most satisfactory article yet proposed for use with water.

Terracolia—Ammonia emulsion of oil with coal tar.

Westrumite—Emulsion of tar and mineral oil with ammonia.

Zibellite—Costs 2.5 cents a pound.

While it is true that by their use the dust can be laid for a short time at a small labor cost, yet in the aggregate, for a season, it amounts to quite a high figure. This is theoretically as it should be, as the mixture of water with the oily mixture to some extent defeats the very object that we wish to obtain, i. e., the securing of a well-bound waterproof surface. Again, the alkalies used in forming the emulsion destroy, to some extent, the bonding power of the oils used, and, furthermore, in many of the preparations the oils are not properly suited to the work in hand.

The same general objections apply to the use of emulsions as apply to hygroscopic salts. They do lay the dust if applied in sufficient quantity, but they have little, if any, permanent binding effect on the road surface. They are almost entirely removed by a heavy rain, as through their application with water they cannot penetrate below the surface of the road. In many cases, particularly with the asphaltic base oils, they have a very disagreeable odor for several days after their application. Again, a number of the patented emulsions are made with an excess of alkali as an emulsifier, and their use occasions considerable annoyance to the eye from the particles thrown by the wheels of motor cars passing shortly after they have been applied.

Surface Coating with Oils.—Coming now to a consideration of the use of surface dressing of oils, we find the first really successful methods of controlling the road dust. The inception of this treatment came from the climatic and physical condition existing in countries having long, hot, rainless seasons, but their use has been extended to other districts with varying degrees of success. The following table gives an idea of the chronological development of its use:

DEVELOPMENT OF USE OF OIL AS SURFACE TREATMENT.

1894—First tried in Santa Barbara, Cal.

1898—Revived in Los Angeles and San Bernardino, Cal., using the heavy asphalt oil, and in Oran, Algeria, using oil of aloes.

1899—A Texas asphalt oil was used successfully in Fort Worth, Tex.; tried in Boston parks, and abandoned on account of odor.

1901—A paraffine base oil was used for oiling a railroad roadbed in Long Island.

1902—The same class of oil was used in some sections of the Pennsylvania Railroad. Texas asphalt oil was used successfully on the shell roads at Galveston, Tex. Experiments at Marion, Ind., on a macadam road with a crude paraffine base oil were not successful, and at Liverpool, Eng.; Denver, Col., reported dust-laying properties excellent.

1903—Paraffine base oils were unsuccessful at the Rock Island Arsenal. Experiments with "Masut," a residue from the Baku refineries, were made in France; not very successful.

1904—The use of the asphaltic base oils from Kentucky was commenced in Fayette county, generally successful, and at Washington with indifferent results.

1905—Government experiments with Texas oil and residues were successful.

Reviewing these results has shown two things—first, that paraffine base oils are not suitable, and, second, that even the asphalt base oils succeed best in dry, warm climates.

The paraffine base oils have no binding properties, and, in fact, are even more than useless, as on macadam roads they serve as a lubricant between the stones in the wearing course, and seem to hasten their destruction by grinding. Again, they evaporate more or less rapidly and soon entirely disappear from the road, and, furthermore, they are not oxidized as the asphalt base oils are, into a tough material resembling the natural bitumens. While all the oils tend to "churn" more or less (that is, tend to form a black, slimy mud) under the action of the frost, traffic and excess moisture from snow, the paraffine base oils are the worst offenders.

The climatic influences are exceedingly important factors in any question of road treatment, and have frequently not received the attention that they deserve. This is especially noticeable in the use of oil. Originated in the hot, dry climate of California, where for eight or nine months there is no rain and frost is unknown, and where the road surface may be secured

perfectly dry, warm, and in an ideal condition to receive and absorb the oil, it has succeeded wonderfully well, but this success has led to its use under the trying conditions of our Eastern climate, where mild weather, snow and frost rapidly alternate, and add to this an annual rainfall of from 35 to 60 inches, so that their indifferent success under these trying conditions is not surprising.

There has been a great deal of experiment and practical work done on the application of oils to road surfaces, and the conditions essential to success seem pretty well understood, so that it seems unnecessary to describe the earlier experimental methods. There are still two points that seem to be in dispute, i. e., whether to sweep the road or not, and whether it is best to heat the oil or apply it cold.

These points may usually be decided by considering the conditions under which the process is applied, but frequently the exponent of one system or the other will endeavor to point out general conclusions from his own restricted conditions and experiments.

The general method seems to be as follows: In very dry climates, and especially on gravel roads, it seems unnecessary to sweep the road. In the Eastern States and on macadam roads this seems essential, but it can be done sufficiently well with a horse sweeper.

The oil should then be applied from some form of sprinkler provided with control over the delivery, such as the White road oiling machine, which was developed in California for this purpose.

In California or the Southern States, or in the Eastern States during hot summer weather, heating does not seem essential, especially with oils containing not over 25 to 40 per cent. of asphalt, but for general use, in the East especially, with the heavier oils, the heated oil can be more easily and economically handled and applied than the cold oil, and seems to give slightly better results, particularly on macadam roads.

Brooming the oil after spreading is generally determined by the way the road surface takes the oil, but at least one or two men should follow the sprinkler when using heavy oil, especially if cold or the road surface is uneven, to brush out all puddles and push any excess into the gutter.

Sanding.—This is exceedingly important, as the value of many oils seems to lie chiefly in the formation of a hard coating of oil-saturated sand, that fills all the surface voids and presents a smooth, resilient surface to the traffic.

In many cases it is found that the surface application of oil, while it only penetrates the original road about one-quarter to one-half inch (the latter is exceptional), tends to loosen and disintegrate the original cementing bond of rock powder, an action similar, no doubt, to its action on cement concrete, so that without a sand wearing surface the road would soon go to pieces.

It is now generally felt that under these conditions the sand should be carefully chosen and applied until the oil fails to come to the surface. A slight excess seems, in the opinion of a number of road engineers, particularly about Boston, to be even desirable.

In general, oiling seems to succeed better on gravel than on macadam roads. There are several reasons why this is so. The gravel road is more porous and allows a greater penetration than in the compact and almost impervious wearing surface of a broken stone road. The action of the oil in loosening the bond in the wearing surface of stone roads has already been noted, and is, of course, a factor against its successful use. In the gravel road the particles especially are subject to more or less motion, from the stresses imposed by the traffic that, owing to the regularity and smoothness of their surface, is not destructive, while in the broken stone road such action is to be prevented, as the surface quickly disintegrates under it. This, then, requires that a surface binder should have such a character that would permit this motion without detriment to its wearing qualities, or, in other words, it should be of a rubbery consistency. This is well exemplified in the base of the California oils high in asphalt.

The proper quantity of oil per square yard is dependent upon the ability of the road surface for absorbing it. An excess is very undesirable, as it requires too much sand to prevent it damaging traffic, and, if too thick, this sanded skin peels and leaves a very poor surface. In general, gravel surfaces will absorb more oil than macadam, depending, of course, on the quality of oil used, and whether cold or hot. The usual practice seems to be from .2 to .3 gallons on macadam, .3 to .4 gallons on gravel, and .4 to .7 gallons on earth roads.

Almost any asphaltic or semi-asphaltic base oil seems to serve for surface treatment, but they should contain from 25 to 40 per cent. of D grade as-

phalt, and be reasonably free from water and foreign matter.

Oiling seems to succeed best on gravel roads in hot, dry climates. It requires for its best results even distribution of a fairly clean road surface. It is easily applied and gives a dustless surface, but frequently gives a good deal of trouble if an excess is used, and in winter, in the Eastern States, churns to a slimy black mud. There is with some oils considerable nuisance from odor and tracking when first applied. The climatic conditions and character of road surface should be carefully considered before adopting its use.

THE CESSPOOL AND ITS DANGERS.*

By Burton J. Ashley, C. E., Chicago, Ill.

DURING last year I received a letter from a prominent clubman of the Northwest, who wrote: "Our cesspools (three largest built locally) won't 'cess,' and have been useless and impossible for the past four years," to which we made the reply that the greatest trouble people find with cesspools, in our experience, is that they do "cess." A cesspool, derived from the word "cease," is a "cease" pool—that is, it is a quitter; it ceases and won't do anything. It may, and does, put forth a strangled effort, but nature's forces become so stultified in these ill-designed contrivances that the active natural agents of purification are completely smothered and die, and thereby the ceasing and consequent danger.

You may as well expect the average cesspool to be successful in disposing of your sewage as to expect a fire to burn in the bottom of a hole in the ground with the top of the hole covered.

The *Saturday Evening Post* recently gave the Merchants' Association Committee on Pollution of the State Waters of New York permission to reprint some articles for general distribution regarding the cause and spread of typhoid fever, and contained in them may be found the following:

"Great cities are developing some sort of a sanitary conscience. Farmers and country districts have as yet little or none. Bad as our city water often is, and defective as our systems of sewage, they cannot for a moment compare in deadliness with that most unheavenly pair of twins, the shallow well and the vault privy. A more ingenious combination for the dissemination of typhoid than this precious couple could hardly have been devised. The innocent householder sallies forth, and at an appropriate distance from his cot he digs two holes, one about thirty feet deep, the other about four. Into the shallower one he throws his excreta, while upon the surface of the ground he flings abroad his household waste from the back stoop. The gentle rain from heaven washes these various products down into the soil and percolates gradually into the deeper hole. When the interesting solution has accumulated to a sufficient depth, it is drawn up by the old oaken bucket or modern pump, and drunk. Is it any wonder that in this progressive and highly civilized country three hundred and fifty thousand cases of typhoid occur every year, with a death penalty of 10 per cent.?"

Let me cite you an instance to illustrate to you the possibilities of water pollution through underground veins or crevices and its lamentable results. The case is an old one to sanitarians, but new, no doubt, to some. A small village in Switzerland, near Basle, is supplied with water from a spring situated at the foot of a mountainous ridge. An epidemic of typhoid fever broke out, which struck down over 17 per cent. of the panic-stricken in habitants of the village. The fever was pretty well distributed through the village, but a group of six families had entirely escaped the scourge. Suspicions were aroused regarding the purity of the waters of this spring, and an investigation was made.

On the other side of the ridge before alluded to was a little valley, which when irrigated, always increased the flow of the spring on the other side of the mountain. It was found that a peasant, living in the valley, had returned from a distant city, sick with a fever, and that the water in a little brook in which his clothes had been washed and into which the slops of the house had been cast had been used to irrigate the meadows. Of course, the polluted water filtered through the sur-

*A paper before the American Society of Inspectors of Plumbing and Sanitary Engineers.

face of the soil and joined the underground water, to go—no one knew where.

In order to determine if it could be possible this spring was fed by the underground waters of the valley over a mile away, experiments were made. A large quantity of salt was thrown into a hole dug in the valley to a water-bearing vein of sand and gravel. In a few hours the waters of the spring became very salty.

They now mixed two and one-half tons of flour with water and poured this mixture into the hole, but after much waiting and close examination not a trace of the flour could be found in the water in the spring.

This proved conclusively that, though the water-bearing vein through which this water had to pass carried salt in solution to the spring, at the same time the granular constitution of the vein was sufficiently fine to prevent the finest particles of flour reaching it.

It should, then, be quite clear to the reader that the passage of water through underground veins is no assurance of its purity, and neither is clearness any proof of purity—for, says Mason: "It is a fatal error to fancy that because a water has a bright, sparkling, clear appearance and a pleasant taste, that therefore such water is wholesome. Carbonic acid gas is what causes brilliancy and refreshing taste of a ground water. When it is borne in mind that carbonic acid is one of the products of sewage decomposition, the inference as to its possible source is not a pleasant one." Neither is turbid water to be adjudged as dangerous merely because it is turbid. While visiting, a few years ago, the city of Defiance, Ohio, which then derived its water supply from the Auglaize river, and on drawing a glass of water from a faucet in the hotel, I was obliged to wait until the heavier suspended particles could settle to the bottom of the glass before its was sufficiently wholesome to drink. The water was roilly and unsightly as well as unwholesome, but was not regarded as unsafe at that season of the year, when the Auglaize river was nearly overflowing her banks in consequence of the prevailing rains.

I recently asked a wealthy manufacturer how he disposed of the sewage of his summer home at one of the lakes in Northern Michigan. "Oh," said he, "I dig a cesspool down to the gravel, and then the stuff runs away." "Where is your well?" said I. "About one hundred feet away," was the answer, and then he proceeded to explain to me, in an assuring way, that the bowel discharges and sink wastes that went into his cesspool would be entirely purified by passing through the strata of fine gravel before reaching the well. Now, this man I know to be a gentleman of splendid intelligence, the mayor of a city and a leading light in his community, but, in spite of his intelligence, he was totally ignorant of what the essential processes are that produce sewage purification. He evidently had in mind that the substrata of gravel would filter the cesspool seepage to purity. He did not know that purification of such foul liquid is impossible without fresh air and the action of aerobes. And here lies the danger: that the common people, and even the most intelligent people, are led astray sometimes through lines of their own incorrect reasoning, and sometimes through erroneous information imparted by pretenders that know nothing of the principles of decay, but try to make folks think they do.

The opportunity for the contamination of well water, particularly in towns and villages or in the suburbs of towns and cities where sewerage is absent, is often very great. It is no uncommon practice for the owner of a small lot to construct his well and a cesspool within a few feet of each other. The contents of this filth hole soak away and mingle with the ground waters, only to reach the well; for even the most ordinary mind can see that as water in drawn from a well the well is replenished by just so much of the ground water surrounding it, and if this ground water is polluted, health and life of your family or neighbors are jeopardized.

The question then might arise as to the advisability of using a cesspool where city water mains were available, but we answer that if we live up to the standard of righteousness and of model citizenship, then it would be an example of the grossest selfishness on one's part not to have an interest in the welfare and health of one's neighbors who might yet be using wells, for through such selfish indifference to the health and welfare of the neighborhood we might be rightfully regarded as undesirable citizens.

Mason also says that "It is hopeless to depend upon the purifying influence of the intervening soil to protect the wells from privy and cesspool fouling, because soil filtration, in order to be effective, must be intermittent." With a constant flow of pollution on or through any soils, the purifying powers of the soil quickly cease to act. Intermittent flow is absolutely essential

to admit air to the aerobic bacteria where present, if purification is to be effected.

E. Bailey-Denton, in one of his courses of lectures delivered to the students of the Royal Agricultural College, England, said of the cesspool as a method of sewage disposal: "It is a system of disposal which I do not recommend, and which should always be avoided if possible, and no matter if built under circumstances most favorable, will remain liable to all the objections to which cesspools are admittedly subject."

Rideal, the well-known English authority on sanitation, has pretty well described the results of harboring a cesspool. He says, and it is reasonable to believe, that "the soil about cesspools becomes water-logged with black fœtid matter which undergoes little or no oxidation." I here wish to add that without oxidation of the seepage of cesspools, saying nothing of the liquids of the septic tank, purification of sewage is not accomplished.

Dr. Bashore, former inspector for the Pennsylvania State Board of Health, in his little work on the "Sanitation of a Country House," says of the cesspool: "It is a relic of medieval shiftlessness and carelessness for which no excuse can be offered."

Prof. Merriman, in his "Elements of Sanitary Engineering," says: "The privy or cesspool is walled up with loose stone so that the liquid material may leak through them into the surrounding soil. The result of this is a gradually increasing pollution of the soil, and often a neighboring spring or well becomes contaminated so as to cause disease." He then cites an instance where a spring had been previously condemned by the board of health, but in spite of the warning the people of the neighborhood continued to drink its water, with the result that twelve cases of typhoid fever occurred, and two deaths. Such an example of repugnant stupidity can scarcely be paralleled. Truly may we say: "What fools we mortals be." Thousands of such cases are recorded in medical journals that never reach the notice of the great groping public.

Dr. Frank E. Adams, of Piqua, Ohio, has the following to say in the "Ohio Sanitary Bulletin": "In our own city we have found traces of discoloration, when excavating for cellars, that were traced to old cesspools one hundred feet away, and no telling how far beyond the excavation the discoloration extended.

"The city engineer tells me that when excavating for a sewer they passed through a discoloration in the soil that extended forty feet in width, the odor arising from it almost compelling the laborers to cease working. He said they were about nine feet deep, and had passed through one foot of this stuff; how much deeper it extended he did not know, as they were then at the sewer bottom, nor the length of it, but that there was no cesspool nearer than forty feet."

Mr. Thomas S. Ainge, sanitary engineer for the Michigan State Board of Health, and a member of this society, in his recent work on the "Sanitary Sewage of Buildings," says that smaller cities and villages resorting to cesspools endanger the water in private wells and create an unwholesome condition of the subsoil in the immediate vicinity, and that such a practice is inexcusable, yet often permitted for years. That boards of health, even to the present day, have a misunderstanding of the relative inefficiency and dangers created by the use of leaching cesspools.

While in Madison, S. Dak., last summer, a remarkable instance of the dangerous availability of a cesspool as a death trap was related to me. The filth hole in question was some four or five feet in diameter, and about ten or fifteen feet deep, reaching a gravel bed, which was supposed to absorb the filth, but did not, and this death trap was full of unfermented human excrement and other foul matters, covered with boards and earth. As a child of the proprietor was passing above and upon the top of it, the top gave way and the child sank into the filth up to her arms. Screaming and sinking, she was only rescued in just time to save her life, and just as her head and chin were reaching the surface of the corruption. We leave you the mental picture to contemplate.

Many cesspools are similarly covered with boards and earth, on which the grass soon grows, and the location is forgotten. It does not take a very great stretch of imagination to realize the direful result which might be caused by such improper construction, which could be directly contributory to the loss of life by accident.

A letter was recently submited to the writer by a well-known publication on sanitation, which, in part, read as follows:

"Will you let me know what is the best way in which to drain the surplus water from a cesspool. As matters now stand, we are compelled to haul this

waste out of town, at an expense of about $15 per month."

A part of our reply was as follows:

"If your cesspool is costing you $15 per month to maintain, then the yearly cost would be $180, which is 6 per cent. on a capital of $3,000. An individual sewage disposal plant should certainly cost you much less than $3,000, in fact, the average price of plants for ordinary dwellings will only range from $200 to $500." I offer this illustration to show the maintenance of a cesspool from the financial viewpoint.

Some two or three years ago I received a letter from an eminent educator and president of a state institution, and the following is an extract from the letter:

"We have dug perhaps a dozen cesspools in the past five years. As soon as one filled up we dug another, until our grounds (college campus) nearly are full of holes."

This institution has since abandoned the cesspool practice, and has installed a modern sewage disposal plant, and a letter dated December 18, 1908, from the superintendent, says:

"Inlet end of reduction tank, no odor whatever; sludge 8 inches deep; mat 10 to 12 inches thick and very tough; sludge slaty gray color. On opening outlet cover found slight odor, but not offensive, and slight scum, but water is perfectly clear."

Regarding this plant I will say that, after purifying this tank liquid by nitrification, the filtrate or water is disposed of by ground absorption wholly, and within the confines of the college campus.

Since the advocates of advanced hygiene have investigated, experimented with and employed modern rational means of self-preservation, and as one of the advanced means people have their surroundings properly sanitated, the death rate in the United States has been decresing until now the average human life has gone beyond the proverbial "three score years and ten." Some have erroneously believed that the hardy pioneers of our land were longer lived than we, but statistics do not prove it. As people employ means to better care for the body, just so is life lengthened.

Typhoid fever decreases in proportion to the increased installation of means of sanitary sewage disposal, and in cities it is in proportion to the increased abandonment of wells as a source of supply of drinking water.

Lawrence, Mass., typhoid death rate in 1890, per 100,000, was above 120, but after employing modern sanitary measures in sewage disposal and water supply, in seven years the typhoid death rate fell to but 16, a falling off at the rate of 104 deaths per year. The contemplation of the satisfactory effects of employing accepted sanitary expedients is rapidly arousing intelligent communities to the necessity of cleanness of person, and the sanitation of surroundings. Hence the introduction of modern devices for cleanliness, such as baths, lavatories and laundries in the modern home, with a rational, safe, sanitary and satisfying means of purifying the poisonous wastes of living and properly disposing of them, is on a speedy increase. The sanitary conscience is arousing everywhere.

A word to the summer hotel or resort keepers, and to the summer visitors themselves. I wish to call your attention to the following Health Bulletin which was recently issued in Chicago, and from which the following is an extract:

"These seekers after rest and happiness are liable to drink polluted surface water in lakes and streams. Open wells are often infected with typhoid fever germs, and are among other sources of typhoid fever. Each year in August there is in this city an increase in typhoid cases, and the investigations show that about one-fourth of all our city cases are contracted in the country, where the victim has been passing his vacation. Typhoid fever is a preventable disease."

From my own experience, and from information acquired from others, it is discovered that the average outhouse conveniences at these country resorts are vile and unrespectable, and are maintained by people who would be highly offended if one should assail their respectability, but I say that he who is the maintainer of one of these unspeakable privies and makes no attempt to abolish the nuisance, but continues to foster the nauseating pest spot and offers it to the use of others, can not lay claim to decency.

To the summer visitor I would say there is something of more vital importance to you when enjoying your summer outing than front verandas with easy chairs or beautiful shade and restful hammocks. Don't patronize the place that does not provide for the safety of your health, as well as for the conscious comforts of your mind and body. Modern methods of sanitation are available, and the average farmer or summer hotel keeper is abundantly able to possess himself of sanitary conveniences which advanced habits of living demand.

A word regarding the prevalence of flies. The prevalence of flies in either city or country very closely approximates the prevalence or immediate presence of manure piles, where most of the flies are hatched. Available privy vaults or cesspools afford their sporting and feeding grounds some of the time, but the dinner table is a popular resort for them when not at the places above mentioned.

D. D. Jackson's report to the Waters Pollution Committee of New York called that body's attention to the presence of vast numbers of disease germs on the feet and legs of flies which had been caught in fly traps for the purpose of microscopical examination, and makes the statement that "the common fly is one of the most active agents in disseminating certain intestinal diseases."

"There are certain laws of consciousness," says Dr. Sedgwick, "that have for their object the preservation of human life to its appointed maturity, as, for instance, to grasp at a support to prevent a threatened fall. This same consciousness universally arouses an instinctive repugnance toward human excrement or any putrefying animal substance, and instantly warns one through this instructive intellectuality that these repugnant ingredients are baneful to life." No person with ordinary intelligence, after having reflectively contemplated the matter of sewage disposal by building a cesspool, ever dug such a cesspool and used it with a satisfying consciousness that the contrivance would be successful, safe and comforting, but he, on the contrary, must have been conscious that he had not satisfied himself in creating this pest spot. A cesspool is a thing that is untrustworthy, disquieting, noxious, harmful, corrupting and dangerous.

"Back to Nature!" is the present cry of city dwellers, and the city dweller who can afford a country home, even though inexpensive, is moving or laboring to the end of moving to the suburbs or to the country and its loveliness and quiet, and the number is legion. Many thousands of New Yorkers now have their country homes in suburban localities. Thousands upon thousands more spend the greater part of the warm season in country homes in the Berkshire Hills, the Adirondacks or the White Mountains, and yet thousands of others, from all the principal cities of the east and south and great middle west are joining in this one grand, determined, happy exodus back to the country that God made, and away from the cities which man made; but though back to the country, some of the conveniences of city life are too comforting to be left behind. To resort to Mosaic sanitation (Deuteronomy 13:23) or to dig cesspools as the Indians do, is quite out of keeping with the character of sanitary conveniences some of these would-be country dwellers are used to, and so they are sufficiently wise to employ modern sanitation in these country homes, that there also they may have the modern comforts common to the better grade of city dwellers. To the discerning the cesspool is tabu.

We have read somewhere about a "septic cesspool." One of the words, "septic," signifies *action*, and the other word, "cesspool," from the nature of its derivation, stands for *inaction*. The logical definition of these two words conjointly used, therefore, would be "active inaction." The absurdity of such a claim is apparent.

I recently read a short article by some writer, who did not sign his name, that the secret of the septic tank was nothing more than that it must be air tight and have a submerged inlet and a submerged outlet, "and that is all there is to it." Just how can this information be harmonized with the fact that for the last ten years or more scores of septic tanks have been built without any cover whatever, and that chemical analysis has shown that the effluent from the open tank is as satisfactory as that from the closed air-tight tank?

I also saw a published statement that tanks for residences would rarely need to be larger than to hold 24 to 36 hours' flow, and that a tank 3 feet wide by 6 feet deep and 8 or 10 feet long would ordinarily be large enough. I have computed and find such a tank to contain 1,300 gallons, which clearly shows the most lamentable ignorance on the part of the writer of the amount of sewage ordinarily produced by private residences.

Great care should be exercised in giving out such flat statements as these, for those who are not posted on the subject would surely be led seriously away from the truth, and would more than likely construct something that would be a flat failure.

One has to select a sewage disposal plant for his home in just the same way he would buy a heating plant. Proper capacity is one of the fundamental elements to successful operation. A party in Ohio once wrote me that if he could not get a sewage disposal plant for his home that would

take care of the sewage of fifteen persons as readily as for two he did not want anything to do with it. I replied, asking him if he would expect a stove that was gauged to burn satisfactorily two scuttles full of coal per day to burn fifteen scuttles of coal with the same satisfactory results. This comparison should be convincing, for sewage disposal plants and stoves are strikingly analogous in their operation.

The laity has been wrongly led to believe that the septic tank purifies sewage. This is positively untrue. The septic tank, settling or reduction tanks, are only a primary means to the end of purifying sewage, the real purification being effected by nitrification or oxidation, which process is accomplished only by bringing sewage or tank liquids into contact with surfaces covered with the aerobic film, and in which the aerobes are kept in active condition by intermittent application of organic wastes and with air.

There are occasional examples where cesspools seem to answer the requirements merely of disposal, but exceptions cannot be held up as an example to follow. Moreover, when a cesspool is able to liquefy the solids that enter it, then it is no longer a cesspool, but a septic tank or hydrolitic tank. But liquefaction in a septic tank is not purification, and moreover, when sewage disposal becomes oversepticized, purification will not take place. It is entirely possible to convert and purify sewage without the tank processes whatever, employing nitrifying bacteria to do all the work. By this means putrefaction does not take place, nor is any fermentative odor produced, for there is no fermentation.

A prominent physician of one of the Southern States remarked in a recent letter, written me, that he did not see the difference between turning sewage loose in the soil and nitrification. I answer that turning it loose into and four feet deep, say, beneath the surface of the soil would be a mighty difference, since nitrifying bacteria do not exist in sufficient numbers at such a depth to be satisfactorily effective. The depth beneath the surface of the ground where unconverted sewage may be applied has everything to do with the degree of nitrification that can be accomplished. Applying organic substance to the very surface of the soil for nitrification can hardly be improved upon by artificial expedients.

The filter bed, the underground nitrification duct or nitrification bed has, therefore, the object of producing the same final processes of purification as are so readily produced at the surface of the soil, and where quantities of sewage are not too large and the character and condition of the soil, water supply and a number of other essential items are fully understood, plants may be so designed for such known conditions as to successfully purify the sewage and then admit of the absorption of the filtrate or water into the soil. By this rational modern sanitary expedient the dweller is safe from the sorrow and desolation that may be caused by harboring that which sanitarians universally condemn—the cesspool.

THE NEW WATER FILTRATION PLANT FOR TOLEDO, O.

By B. M. Baker, Toledo, O.

WHEN the new filtration plant now under construction at a cost of near a million dollars is formally opened for use by the first of the year, Toledo will have one of the most modern and up-to-date filtration plants in the entire country. The work on this plant has been under way since the spring of 1906, and only a visit to the plant can give a conception of the magnitude of the undertaking. Comparison of filtration plants is difficult, as every locality has its special features, its peculiar local evils to contend with, so that every filtration plant is different in some essentials from every other.

In general design the Toledo plant has some striking features which add to its accessibility and make it a model of its kind. The pipe gallery, for instance, instead of being a mere jumble of inaccessible and complicated pipes, is of such proportions and cleanliness that the workmen about the plant have named it "Lovers' Lane." Here the pipes are conveniently arranged on either side of a wide promenade, and every pipe can be reached with ease. The 20 filters are conveniently located,

and controlled by gate controllers which can be set at any desired amount up to 1,000 gallons. The indicator shows at all times the position of each valve, and the operator, standing by, can watch the entire operation of washing the filter. The grounds, laid out for 60,000,000 gallons, are so constructed that an addition can easily and cheaply be made at any time. The temporary wall at the rear of the filter plant, for instance, is so constructed that it can easily be extended, and 10,000,000 gallons can be added to the capacity without changing the settling basins. The chemical and bacteriological laboratories are especially convenient in arrangement, and small sample pumps are connected with the chemical room, so that the chemist can easily analyze the water at any time.

The requirements confronting the sanitary engineers in the construction of the filtration plant were: softening processes, the removal of all classes of bacteria (which abound in the Maumee river), and dispersing the turbidity, which at times is extreme. One of the very important items is the softening process, which means much to the city, not only for culinary and bath purposes, but on account of the formation of scale, which has been a source of great annoyance to manufacturers using water in boilers.

The water supply for Toledo is taken from the Maumee river at a point one mile northeasterly from the southerly line of the city, at Broadway. From the lake to a point seven or eight miles above the present pumping station the Maumee river is an arm of the lake, which fluctuates to an extent of nearly 25 feet. A drop in the level of 11 feet has been produced by a strong southwest wind, and a rise of something over 14 feet has been produced by ice gorges. Ordinarily the current in this part of the river is slight, but at times of extreme high water it becomes very strong. Under ordinary conditions the water in this arm of the lake is moderately turbid, except when it is disturbed by a high wind or when the clearer water has been displaced by highly turbid water coming down from the rapids above. Between Toledo and Grand Rapids there is a fall of 60 feet, which produces a very strong current, except in the level stretches, which occupy about one-third of the distance.

The pumping station of the filter plant was built on the opposite side of the River Road from the river, as it was feared that high water and ice gorges would cause much damage and difficulty if the station were located on the river's edge, as at first intended. To deliver the water supply to the pumps an intake pier or submerged crib was located approximately 800 feet from the shore toward the channel of the river. From this intake the water flows through a 48-inch cast-iron submerged intake pipe to a concrete shore well 10 feet inside diameter. The bottom of the well is 27 feet below mean water level. A brick gate house, of circular plan, is built above the operating floor, which is set at an elevation of 18 feet above mean water level. From the shore well the water flows through a 6-foot concrete tunnel 500 feet long to the suction well in the pump room of the pumping station.

The pumping station is a brick and steel structure, with a tile roof, and is 70x170 feet dimensions. The machinery room occupies the easterly 115 feet of the building, and has a depressed floor. This is in part occupied by a circular pump pit 75 feet in diameter. The pump pit is 41 feet in depth below the main floor of the machinery room, and at the bottom of the pit are to be located two direct connected gas engines and rotary pumps, space being provided for four additional units. On the main floor of the machinery room will be located three generators direct connected to three gas engines, one unit being of 200 and two units each of 100 k. w. capacity.

Located between the pumping station and the filter plant proper is a reservoir for the storage of raw water, 250 feet square. This basin is of concrete construction, and has a capacity of 5,000,000 gallons. The floor takes the form of inverted flat-groined arches, supporting columns spaced 15 feet centers. The roof consists of groined arches having a rise of 3 feet. Around the head house and the two coagulating basins is built an earthen embankment rising to the top of the first story and entirely concealing the side walls of the coagulating basins and the concrete story of the head house. The roofs of the coagulating basins and of the clear-water reservoir are covered with earth to a depth of about 2 feet to permit of sodding or seeding.

In the machinery room and over the chemical tanks are located various machines and devices for dissolving and mixing the chemicals, agitating the solutions, pumping water to and from chemical tanks, pumping the filtered water and furnishing the compressed air used in washing the filters, pumping chemicals, etc. All this machinery is electrically driven. All pumps are rotary pumps. The compressed air is

furnished by two duplicate Root blowers having a capacity of 1,500 cubic feet of free air per minute against a pressure of five pounds. As far as possible, motors have been duplicated, both as regards speed and horse-power, so as to minimize the number of reserve parts necessary, and to permit of substitution in case of accident.

The generators in the pumping station are expected to furnish current for lighting the grounds, buildings, coagulating basins and the clear-water reservoir, and to furnish all the power to be used in and about the plant aside from the main pumps in the pump pit. Direct current of 220 volts will be used. All the cables and wires for the transmission and distribution of current are in conduits connecting the different basins and buildings and outside lights.

The pumps at the high service pumping station take their suction from wells connected by tunnel and submerged intake pipe with an inlet crib. The water in the suction wells stands substantially at river level. In order to connect the filtered water supply with these pumps and to permit the use at pleasure of either the present supply or the filtered water, connections are being made to the suction of the pumps by introducing in each of the suctions a valve and a tee between it and the pump. To this tee will be connected the filtered water suply, which is controlled by a valve located near the tee. These valves are gate valves, double disc and piston, operated hydraulically, and tested at 300 pounds pressure.

When the filter plant is in operation the water will be delivered to the pumps at the high service pumping station at an elevation varying from 30 to 46 feet above the river level. This will reduce the coal consumption, and in part compensate for the nigh head pumped against at the low service pumping station.

The valves and sluice gates controlling the flow in the various pipes, conduits, etc., are generally hand operated. The valves used in the filter house and in the high service pumping station are, however, operated hydraulically.

The coal will be received at the low service pumping station on a siding elevated about 6 feet above the level of the ground. From the cars the coal can be dumped or shoveled into a concrete underground coal bin having a capacity of 250 tons. Underneath this bin is a low story which permits the coal to be drawn from the bin, crushed and delivered into cars by gravity, or taken to the cars direct. An industrial track permits a car carrying a ton of coal to be taken to a platform elevator, which elevates it to a level somewhat above the top of an overhead storage bin. This overhead bin has a capacity of approximately 70 tons of coal, which feeds by gravity to the various producers.

Two gas producer units will be installed, each capable of gasifying 300 to 400 pounds of bituminous coal per hour for a period of two or three hours.

To assist in the erection, repair and maintenance of the machinery in the machinery room there is a traveling overhead crane sweeping the entire room, which is hand operated and has a capacity of 10 tons.

It was found that the waste heat from the gas engines would be more than sufficient to heat the buildings, and it is accomplished by the following method: The jacket water from the cylinders of each gas engine goes to a heater through which the exhaust from the engine is passed. This effectively muffles the exhaust and furnishes water at a temperature of about 210 degrees Fahrenheit. The water passes through the system of pipes and radiation, which heats the different buildings and returns in part, to be again passed through the packets on the cylinders, the heater, etc. The return water is at too high a temperature to permit of satisfactorily cooling the cylinders. It will therefore be necessary to add to it previous to its entering the cylinders sueh a percentage of cold water as will reduce it to the proper temperature. The surplus hot water not returned to the cylinder jackets is discharged into the influent well in the head house, the cold water supply being taken from the city mains.

The filtration plant proper is divided into the head house, the filter house, and two coagulating or sedimentation basins. The force main leading from the pumping station to the filter plant is 42 inches in diameter, and consists of riveted steel pipe made from plates ¼ inch thick and protected by a coating of mineral rubber.

The head house is a brick and concrete structure 50x270 feet, with the large dimension north and south. The main entrance is centrally located at the east end of the building, and leads into a large foyer, from which extends an iron-railed concrete stairway. In the north half of the head house chemicals are stored, and there is also room for a small shop. On the second floor over the shop are located the chemical and bacteriological laboratories. The south half of the main building con-

tains a machinery room and four chemical tanks on the first floor. Two of these tanks are for the preparation and storage of a solution of lime, and two are for the preparation and storage of a solution of either sulphate of alumina or sulphate of iron. On the second floor over these tanks are located the mixing machinery and dissolving tanks for the preparation of the solutions.

Extending easterly at right angles from the north and south ends respectively of the head house are the two coagulating or sedimentation basins. These are each 100 feet in width and 500 feet in length, and have an effective capacity of 5,000,000 gallons each. These basins are of concrete, having concrete roofs, and each is divided longitudinally by a wall extending along its center line from the east end to within 50 feet of the west end.

Between these basins extending westerly from the center of the head house is a space of 70 feet in width reserved for filters having a capacity of 60,000,000 gallons per day. At the present time 20 filters occupy this space for a distance of 170 feet. The floor of the filter house is on a level with the tops of the filter tanks and also with the second floor of the head house. To the height of this second floor all of the construction is of concrete or stone. Above the second floor the walls are of brick. The roofs are of red tile.

The water entering the influent well through the force main divides into two parts, one part going north and reaching the filters by the way of the north coagulating basin, while the other part traverses the south basin. The entrance to the north coagulating basin is located midway between the baffle wall and the north wall at the east end, from which point the water flows west the entire length of the basin. It then returns to the east end of the basin through the south half. It is then led south through a concrete duct or tunnel to a central point in the east end of the filter house, where it is joined by the water which has traversed the south basin by a route symmetrical with the one described. After entering the filter house the water passes through a concrete channel located between the two rows of filters, which it enters under control through openings leading to the right and left. After passing downward through the filters the water is collected from the different filter units by clear well or conduit through which the water flows easterly and then along the river road to the present high service pumping station, a distance of 2½ miles.

The sand used is sea sand from Cape May, on the Jersey coast, and the pockets have a filling of graduated sand and coarse gravel. The gravel in the bottom is 9 inches deep, with 37 inches of sand on top. This sand has an effective size of .40 of a millimeter and a uniformity coefficient of 1.5.

The basins are to be cleaned out several times a year, and are connected, by gates at the bottom of the basins, with a sewer which is carried down the river past the intake.

The building of a filtration plant was first conceived in 1904, when plans and specifications were first begun. In 1905, after the awarding of a portion of the contracts, litigation was started in the local courts which tied up the work until the spring of 1906, since which time work has been steadily under way. It is hoped to have the plant ready for use this fall, and stated with certainty that it will be ready for use by January 1 at the latest.

EDITORIAL COMMENT

Where Business is a Pleasure.

Municipal Legislative Reference Libraries.

Professional Mayors.

WHERE BUSINESS IS A PLEASURE.

In another department will be found a statement of the entertainment features of the next convention of the American Society of Municipal Improvements, which will be held in Little Rock, Ark., Nov. 9 to 12. While these are termed entertainments, it will be seen that they all have a preponderance of educational elements and that the industries and the municipal improvements of two large southern cities may be studied and much benefit may be gained in combination with the pleasures which the hospitable natures of the southern hosts of the association will supply.

There will be six business meetings of the association, at which may be expected the usual valuable discussions of the practical questions arising in connection with the administration of the construction departments of municipalities. The association has been noted throughout its existence for the very high character of its members and of its deliberations, and city officials who once become acquainted with it continue their memberships, even after leaving municipal office. A large proportion of what may be termed the permanent membership of the society is made up of engineers and others who do not hold city offices, although they have frequent engagements in municipal work in one form or another.

The first objection often made by city councils to appropriating the money for sending to the conventions the city officers having the municipal improvements in charge, is that it will be spent on a pleasure trip. But while the official will undoubtedly enjoy his trip, the principal return is in the direct benefit which the city will receive from the new view of his work which the official will secure and the large amount of practical information which he can obtain concerning the problems in his own city, on account of the discussions with many of the foremost experts in those problems who will be present and who can there be induced to share their experience with their fellow members. With the possible exception of the first two or three conventions back in the ancient history of the organization, there have been no traces of the "junket" in its meetings. The political features of municipal government have been entirely eliminated from the society, which is composed wholly of those interested in the administration of municipal public works and in the technical features of their maintenance and operation.

Any municipal official from mayor to street sweeper who is interested in the improvement of his city on the material side will find profit in attending the convention, and any city will find profit in sending such interested officials to the Little Rock meeting.

Once a member always a member is a rule with few exceptions. Unfortunately the average life of municipal officials is short and so the changes in membership are frequent, but several present members attended the first convention and are still enthusiastic and the back-bone of the association is largely composed of men who joined during the first half of its existence and are located in cities where merit is acknowledged and kept permanently in office or have retained their interest although severing their direct connections as municipal officers or permanent employes.

While membership alone gives one the printed copy of the proceedings and other general benefits of the so-

ciety, the maximum of value can be obtained only through the personal contact and discussions which are available only at the conventions and the attendant inspection trips and conferences of small groups.

MUNICIPAL LEGISLATIVE REFERENCE LIBRARIES.

A discussion of this subject and of the relation of the city public library to the work of such a department was given at the last conference of the American Library Association by Samuel H. Ranck, the librarian of Grand Rapids, Mich.

He cites the legislative reference libraries of Baltimore, Newark and Chicago, which have been noted in MUNICIPAL ENGINEERING, and of Milwaukee. Boston also has a department of statistics. The state libraries of Wisconsin, Indiana and New York also have departments of the same nature, devoted primarily, however, to state legislation, but paying some attention to municipal matters. Mr. Ranck himself has been doing some valuable work in this direction. Such a magazine as MUNICIPAL ENGINEERING collects in a rather brief period a vast amount of the material which is valuable in such a library and, while it is maintained for the purpose of giving information to its readers upon request, and has no special appropriation, it probably contains as much material available for practical use as any of the young libraries mentioned.

Mr. Ranck deplores the frequent necessity of sending more or less well designed series of questions to city officials for information, and if he should consult with the officials of the U. S. departments which attempt to collect such statistics upon uniform basis he would more deeply deplore the inability of the questioner to reduce the information obtained to definite form and common basis.

For years the list of questions was the only way to get information of any kind, and committees of municipal societies have made themselves nuisances with their numerous attempts at collecting all kinds of information. City officials are constantly imposing upon each other in this way, and the newspapers have taken up the fashion. The result upon the city official, whether he is hard-worked or ignorant or simply lazy is much the same. He either does not reply or fills in the blanks with the least labor possible. The result upon the questioner is either confusion or great danger of misunderstanding and consequent misleading.

Were all the questions asked upon a common basis the difficulty would not be so serious, for then a uniform system of keeping records would enable the proper official to fill in the blanks from his last annual summary. But there is no uniformity at either end of the line.

Mr. Ranck's suggestion that some one official, whether the city librarian or some other of the recording and filing departments, be made the center of deposit of all the information about the city's activities and the recipient of all reports from other cities and all questions from other cities, whether from officials, newspapers or individuals, is excellent and would go far to bring order out of the present chaos. The municipal reference libraries above mentioned are of this nature, and similar departments can be maintained in other cities without expense, or at most with little beyond the employment of a clerk or two.

The problem of uniformity will confront these bureaus as it has the state accounting bureaus of Ohio and Indiana, and the public service commissions of Massachusetts, New York and Wisconsin and the general showing of the necessity for uniformity will bring the laws necesary to secure it.

The agitation for municipal legislative reference libraries is therefore timely and their work can be made extremely valuable.

PROFESSIONAL MAYORS.

Another business man has returned from a visit to Germany, during which he made more thorough observation of conditions than the ordinary traveler and comments with approval upon the system of appointing municipal officials in vogue in that country. He tells in the Greenville, S. C., *Piedmont* of an

experience with the government of a little town. He was taken before the mayor on the charge of crossing the railway tracks. That item of business being transacted he discovered that the mayor was almost as much of a stranger in the city as he was. Inqury brought out the information that the mayor had been employed by the municipality and brought in from a distant point to take the position he held. In other words, the mayor was a professional man, an expert, and was hired after investigation into his experience, training and other qualifications, just as engineers, accountants, meat and milk inspectors and others are (or at least should be) employed in this country. He had been to a training school and was supposed to know the business of being mayor. Popularity had nothing to do with his employment. He was hired through a business agreement to do certain things to the satisfaction of his employers. Failure to "deliver the goods" meant "twenty-three" or "good night" for him.

If the investigation had been carried a little farther it would have transpired that other city officials are employed in the same way, and it probably is true that the mayor began his apprenticeship, after graduating from the training school, in some subordinate position in the administrative department of a town or city and had been promoted from bureau to bureau and from city to city until he attained the mayoralty in the town in which our American had his little trouble. No doubt if he did his duty properly he would again be called higher when some larger city found itself in need of an experienced man for mayor.

This es an excellent example of the operation of a municipality as a business proposition. Partisan politics has no more business in the selection of a mayor for a city than it has in deciding on which steamer the citizen of South Carolina should sail on his return home. It is a question of service and the value of the service in either case, and the name of the candidate for president for which he voted is of no more consequence in the one case than in the other.

The American citizen is beginning to learn that he knows little about the government of the city in which he lives and that the men for whom he votes know sometimes less than he, and when he gets beyond the period of apathy through which he is passing and learns that intelligent objection to incompetence and demand for good service from his servants, the municipal officials, does not put him in the class of objectionable "kickers," which is so obnoxious to him, he will demand the same business-like devotion to duty which he now demands from the men to whom he intrusts his own business interests.

He will find in Germany and to a certain extent in England systems of selection of experts for expert service which he can modify to suit American citizens. And when he studies the English developments he will find that the higher quality of service there found is also in large part the result of the demand of the individual for good service, expressed whenever the official or the system of which he is a part fails to attain the highest ideals.

The American citizen will find sufficient exercise of his desire to vote in the selection of the council, the board of directors of his corporation, who can be instructed by and vote regarding the work he wants done and the general policy of the administration, but where the details of the carrying out of that policy are concerned he will demand servants made expert by training and practical experience and kept in the service by reason of sufficiency, and not excess, of salary and by permanence of employment.

The improvement will begin when these facts are recognized. The beginning is delayed because the election of mayor or councilman (or engineer or controller in too many cities), is supposed by some occult transformation to give him all the training and ability necessary for expert service in the office, no matter how poor a lawyer or saloonkeeper or contractor or reporter he may have been in the past.

The spread of the commission plan will have one good effect, that of weakening if not breaking down entirely the

party lines, and it will familiarize many with the method of selecting the mayor through the board rather than by direct vote of the stockholders, (or citizens). It is to be hoped that the failures of some of the applications of the plan which are already foreshadowed will not cause a complete reaction to the old political methods.

THE QUESTION DEPARTMENT

How to Apply Waterproofing Composition te Concrete.

In the "Hand Book for Cement Users," on page 206, the 4th paragraph, it tells the process of waterproofing used by U. S. government engineers. Now I don't exactly understand how to fix up the waterproofing. I fixed up the lye, alum and water all right, but how to add the cement I do not understand; that is, how much. It says "to one part of which is added 10 pounds of cement." How much is one part of the solution already formed? And would that not make a very stiff and compact mixture? And how is it applied?

K., E. Reno, Okla.

The word "part" referred to above is a misprint for "pint." Enough water should be added to produce a solution readily applied with a brush. About a quart of water, or perhaps a little less, for each pound of cement will be found sufficient. One workman who has used the process mixes the water and the cement first and then thoroughly stirs in the pint of waterproofing composition. Keep the paint thoroughly stirred or the cement will settle and the application will not be uniform.

Cost of Making Cement.

Can you advise me whether the combination of limestone and cement rock has any advantage in cost of manufacture over the combination of limestone and clay or shale, and if so, about how much?

W. S. M., New York City.

It is generally understood that the combination of limestone and cement rock has some advantage in respect to cost over that of limestone and clay or shale in making cement, but the amount of difference will be estimated differently, according to the experience of the estimator. Some will put the difference at 25 cents a barrel, others much less. Differences in other conditions greatly affect the estimates. Eckel's "Cements, Limes and Plasters" ($6), gives full descriptions of the methods of manufacture and some indications of the differences in cost. He also has a book on "The Portland Cement Industry from the Financial Standpoint" ($2) which will be found interesting in this connection.

Books on Portland Cement Companies and Plants.

What books have been published dealing with the financing, design, construction and operation of a Portland cement mill?

H. D. O., Stephentown, N. Y.

The American books on the subject are by E. C. Eckel. They are "The Portland Cement Industry from a Financial Standpoint" ($2), published in 1908 and reviewed in MUNICIPAL ENGINEERING, vol. xxxvi, p. 259; and "Cements, Limes and Plasters" ($6), published in 1906 and reviewed in vol. xxx, p. 231. Redgrave's "Calcareous Cements" ($3), is an English book having some chapters on the manufacture of cement, reviewed in vol. xxx, p. 59.

Naske's "Die Portland Cement Fabrikation" (18.50 marks), is an excellent book on the technical manufacture of cement, kept up to date by the issue of new editions, the latest being reviewed in vol. xxxvi, p. 190. Another German book is Timm's "Waermetechnische Grundlagen von Drehoefen und Kohlenstaubfuerung" (4 marks), reviewed in vol. xxxv, p. 191.

Information About Reinforced Concrete Bridges.

Please give me information about reinforced concerte bridges and their cost.

B. F. G., Lewistown, Pa.

The following are some of the books devoted wholly or in part to reinforced concrete bridges: Tyrrell's "Concrete Bridges and Structures" ($2.50); Turneaure's "Principles of Reinforced Concrete Construction," ($3); Taylor and Thompson's "Concrete, Plain and Reinforced" ($5), has one chapter on arches; Gillette and Hill's "Concrete Construction Methods and Cost" ($5); Buel and Hill's "Reinforced Concrete" ($5); Ketchum's "Design of Highway Bridges" ($4); Mensch's "Reinforced Concrete Pocket Book" ($10); Reid's "Concrete and Rein-

forced Concrete Construction" ($5); Reuterdahl's "Theory and Design of Reinforced Concrete Arches" ($2); Heidenreich's "Engineers' Pocketbook of Reinforced Concrete" ($3); Gillette's "Handbook of Cost Data" ($4); Marsh's "Concrete" ($3).

MUNICIPAL ENGINEERING has many articles of value upon this subject. Among those in vol. xxxvi, the last volume, the following may be mentioned: "Cost of Concrete Bridges," pp. 154 and 172; "Concrete Bridge Specifications," p. 227; "A Comparison of Bridge Waterways," p. 92; "Dimensions of Concrete Arch," p. 246. On p. 111 will be found a long list of previous articles upon the subject of reinforced concrete bridges, arches and bridge floors.

Concrete and Brick Sewers.

If you have an article on concrete sewers as against brick sewers in your recent issues, please refer me to it.

A. J. G., Metropolis, Ill.

In vol. xxxvi, p. 108, is an article on the durability of concrete sewers. On page 379 is one on concrete and vitrified pipe for sewers, and in vol. xxxvii, p. 34, is a list of earlier articles giving experience of many with concrete sewers. There may be added to this list one on "Concrete Sewer Pipe for Denver, Col.," in vol. xxxvii, p. 203, and one on p. 112 on "The Destruction of Concrete by Alkali."

Books on Concentration of Iron Ores.

Can you furnish us a work on the dry concentration of iron ore, i. e., by drying or roasting, crushing, screening and removing the dust, clay, etc., by fan blast. Kindly give us name of paper published in the interest of iron mining.

C. M. M., Wappapello, Mo.

Can any of our readers refer us to the book desired? The following books have each one or more chapters devoted to the subject of iron ores in more or less detail, but probably none of them give full detail as to the particular method referred to: Richard's "Ore Dressing" ($10); Kunhardt's "Ore Dressing, Foreign Methods" ($1.50); Davies's "Earthy and Other Minerals and Mining" ($5); Kendall's "Iron Ores of Great Britain and Ireland;" Turner's "Metallurgy of Iron" ($4.50); Thurston's "Materials of Engineering, Part II, Iron and Steel" ($3.50); Spon's "Dictionary of Engineering" ($15, parts 40 to 80 cents each); Roberts-Austen's "Introduction to the Study of Metallurgy" ($5.50).

The writer knows of no periodical devoted exclusively to iron mining. The "Engineering and Mining Journal" ($5 a year) is a standard publication covering the whole mining field.

Information About the Septic Tank.

Our city is contemplating putting in a partial sewer system, supplemented by the septic tank. Please give me what information you can on this subject. If you have back numbers that describe in detail the construction of the septic tank, disposal of the outflow, quantity of water required per house or per capita, what part of the septic tank is patented, and if you have books on this subject that are reliable mention them.

O. E. H., City Engineer,
———, Cal.

The American book giving most detail concerning sewage disposal plants, including a statement of all the American patents on processes and apparatus, is Venable's "Methods and Devices for Bacterial Treatment of Sewage" ($3). The system most fully described combines the septic tank treatment with a subsequent filtration. Other books treating more or less fully the subject, all English but the last three, are the following:

Dibdin's "Purification of Sewage and Water" ($6.50) is perhaps the most satisfactory statement of English practice. Barwise's "Purification of Sewage" ($3.50) covers briefly the whole field and gives the septic tank like consideration. The second volume of Moore and Silcock's "Sanitary Engineering" (2 vols. $14) gives the most detailed descriptions of existing plants. Dunbar and Calvert's "Principles of Sewage Treatment" ($4.50) devotes nearly half its space to tank treatment of sewage. Raikes's "Design, Construction and Maintenance of Sewage Disposal Works" ($4) has a short chapter on the treatment of sewage in tanks. Cosgrove's "Sewage Purification and Disposal" gives some details of construction, particularly applicable to small tanks. Gerhard's "Sanitation, Water Supply and Sewage Disposal of Country Houses" ($2) also has many details for small plants for single houses or small collections of houses.

Lists of articles in MUNICIPAL ENGINEERING on the septic tank, which cover fully American practice, will be found in vol. xxxvi, p. 241, vol. xxxiii, p. 249, and vol. xxxi, p. 280. More recent articles are "Methods of Sewage Disposal," vol. xxxvi, p. 362; "Cost of Disposal Plant," vol. xxxvii, p. 106.

Books on Sewage Disposal.

Kindly send me names of books on the subject of sewage disposal works and oblige. W. S. C., Billings, Mont.

Descriptive lists will be found in MUNICIPAL ENGINEERING, vol. xxxiii, p. 175, and vol. xxxv, p. 245. See also the article giving "Information About the Septic Tank" just preceding in this department. The following additional books may be named: Baker's "British Sewage Works" ($2); Vernon-Harcourt's "Sanitary Engineering with Respect to Water Supply and Sewage Disposal" ($4.50); Rideal's "Sewage" ($3.50).

What is the Zero of Elevations on the Earth.

I am desirous of learning the following, and would esteem it a favor if you would express your opinion in regard to same

through the question department of the magazine:

First. What is the elevation of the North Pole, also South Pole. Second. What, if any, is the difference between sea level at New York and San Francisco?

MONTANA SUBSCRIBER.

1. If Cook and Peary have actually reached the North Pole we must accept their information that the elevation of that point on the earth's surface is zero. As no one has yet reached the South Pole we have no information as to its elevation except Lt. Shackleton's statement that it is probably located on a plateau 8,000 to 10,000 feet above the sea level.

2. Theoretically there should be no difference in the elevation of true mean sea level at New York and at San Francisco, and if there were no motion of the sea this would be true. The earth is theoretically a spheroid, but practically it differs somewhat from a symmetrical figure and each measurement of an arc of latitude or longitude gives data for a new computation of the form of the spheroid.

Were the entire surface of the earth fluid, like the sea, the mean elevation of the surface of the sea would be the surface of the spheroid and this would be everywhere the zero of elevation. The interposition of continents and the action of the tides and winds produce irregular motions in the surface of the sea, which cause variations in level, possibly sufficient to show in points so far removed as New York and San Francisco, or so close as the two ends of the Panama Canal, were there methods adequate to measure the difference. The actual elevation of the surface of the sea at any place is, however, something which varies from minute to minute, so that it is necessary to assume that the true sea level at that point is at a point somewhere between the extremes of elevation of the sea surface. Mean tide is the term applied and one of the important series of observations at each sea port is that by which the elevation of mean tide is determined. Evidently a long series of observations is necessary to cover all possible if not all ordinary conditions, and so the elevation of mean tide computed at any time may be slightly changed at any future time. Were there no constant local conditions to produce a constant difference, and were it possible to determine mean tide exactly, there should be no difference in elevation between mean tide at different points on the sea coast. The zero of elevation in almost every instance is so much more accurately obtained from mean tide than by any other method of leveling that the nearest point for which any long-continued observations for mean tide have been made is taken as the zero point from which to carry lines of levels or on which to check them.

The North Pole being defined as the point at which the northern semi-axis of the spheroid pierces the surface of the earth it is evident that as the surface of the earth at that point is sea, the elevation of the North Pole is zero, within the limits of variation, some of whose causes have been suggested.

Our lines of precise levels, as well as trigonometric levels, are carried from sea-level to sea-level, due corrections being made for curvature of the spheroid, which corrections are not exact because we do not know the exact shape of the spheroid.

Were the sea not in constant motion the sea level would locate a surface on which the attraction of gravitation is everywhere the same. This surface is sometimes defined as the zero of elevation. The mean tide determinations may differ from this surface on account of local conditions, but ordinarily by amounts too small to be determined by any of our methods of operation, as above stated.

For all practical purposes, therefore, and at practically all points on the coasts of the seas, well determined mean tide elevations may be assumed as zero elevations within the narrow limits of error of observations.

Specifications for Bituminous Macadam Pavements.

Could you tell us where to obtain copies of the various specifications under which tar macadam work has been done in this country. We would like these as far back as ten years ago if possible, although we are more interested in the specifications of the last three to five years.

W. B., St. Louis, Mo.

The best collection of specifications for the various kinds of bituminous macadam pavements will be found in the volumes of MUNICIPAL ENGINEERING. The distinction between true bituminous macadam pavements and pavements whose surfaces are treated with bituminous materials is sometimes hard to draw, as there are varieties running all the way from bitulithic at the one end to the road oiled for dust abatement at the other. The following articles in MUNICIPAL ENGINEERING treat mainly of the bituminous macadam varieties, some of them giving descriptions which are general specifications for the construction and others giving the construction specifications in detail:

In vol. xxxvii: "The Cost of Adapting Macadam Roads to Automobile Traffic," p. 143; "Automobile-Proof Roads," p. 201; "Some Considerations of the Necessary Changes in Construction to Adapt Macadam Roads for the New Traffic," p. 109; "Materials for Tarring Macadam Roads," p. 18.

In vol. xxxvi: "Experiments on Bituminized Macadam Pavements," p. 358; "Tar for Macadam Roads from Small Gas Plants," p. 370; "Liquid Asphalt for Treating Macadam Roads," giving the New Jersey specifications, p. 396; "Road Preservation with Tarvia," p. 400.

Vol. xxxv: "Technolithic Pavement," p. 125; "The Mineral Rubber Pavement," p. 372; "Asphaltic Country Roads," p. 386.

Vol. xxxiv: "Device for Making Bituminous Macadam Mixtures," p. 33; "Kentucky Rock Asphalt Macadam," p. 268; "Experiments with Tar and Oil on the Highways of Rhode Island," p. 283; "Materials for Tarring Macadam Roads," p. 355.

Lists of articles appearing prior to the above will be found in vol. xxv, p. 246, vol. xxiv, p. 360, and vol. xxxii, p. 242, the last named giving references to articles containing specifications for the earlier forms of tar macadam pavements, in Hamilton, Ont., for example, and for the bitulithic pavement.

English practice is detailed in a paper before the Institute of Sanitary Engineers by Thos. B. Simmons on "Road Construction to Minimise the Dust Nuisance"; in a report by Harold A. Hosking on "Road Resurfacing Experiments in Cornwall" and in many other reports and papers, some of which will be found in *The Surveyor and Municipal and County Engineer*, published in London. There were several detailed papers on this subject by American and foreign engineers before the International Road Congress held in Paris last year.

In Ryves's "The King's Highway" will be found specifications for bituminous macadam according to English practice.

There were several papers going into detail of specifications for various kinds of bituminous pavements before the road congress held in August in connection with the Seattle Exposition. There was an excellent detailed discussion of the subject, led by Arthur H. Blanchard, at the last annual convention of the American Society of Civil Engineers.

Specifications under which bitulithic and other bituminous macadam pavements have been laid can be obtained from the proper city officials of such cities as Knoxville, Tenn., Indianapolis, Ind., Moline, Ill., Mankato, Minn., the Lincoln Park Commissioners of Chicago, Ill., etc.

Warren Brothers Company, 59 Temple st., Boston, Mass., the Barrett Manufacturing Co., with offices in all the large cities, the road oil department of the Standard Oil Co., 26 Broadway, New York, F. J. Lewis Mfg. Co., 1160 S. Robey st., Chicago, Ill., National Bitumen Co., Indianapolis, Ind., Standard Asphalt and Rubber Co., 205 LaSalle st., Chicago, Ill., General Asphalt Products Supply Agency, 59 Pearl st., New York, American Asphaltum and Rubber Co., 600 Harvester Bldg., Chicago, Ill., The Texas Co., Dept. A2, New York City, The Indian Refining Co., 115 Broadway, New York, and Cincinnati, O., The Globe Asphalt Co., 405 Blackwell Bldg., Pittsburg, Pa., al supply materials for bituminous pavements and some of them construct pavements as well, and many, if not all of them, can supply specifications for the use of their materials.

In this issue of MUNICIPAL ENGINEERING will be found two sets of specifications.

Use of Asphalts of Various Kinds in Pavements.

Can you give me any information about the use of asphalt of various kinds as compared with the use of Trinidad asphalt in pavements, especially in the states of the middle west?

C. N. G., Norman, Okla.

There is no record which will give this information with any accuracy. For the entire United States perhaps a comparison of the domestic productions will give some idea, since paving is the use which demands the most asphalt, and the difference in proportions of the two classes of asphalt used in other ways is not large.

The following figures are taken from the annual volume on "Mineral Resources of the United States," issued by the U. S. Geological Survey:

1904:

Domestic production in tons:

Bituminous rock	48,439
Oil asphalt	44,405
All other kinds	15,728
Total	108,572

Foreign importation in tons:

Crude	117,184
Dried	16,766
Bituminous limestone	6,496
Total	140,446

1905:

Domestic production in tons:

Bituminous rock	45,302
Oil asphalt	50,169
Gilsonite	10,916
All other kinds	8,880
Total	115,267

Foreign importation in tons:

Crude	85,014
Dried	9,688
Bituminous limestone	5,895
Total	100,597

Of the importations 67,282 tons were from Trinidad lake and land.

1906:

Domestic production in tons:

Bituminous rock	24,085
Oil asphalt	62,454
Gum	24,178
Gilsonite and elaterite	12,947
All other kinds	14,395
Total	138,059

Foreign importation in tons:

Crude	100,818
Dried	14,178
Bituminous limestone	5,086
Total	120,082

Of the importations 77,194 tons were from Trinidad.

1907:

Domestic production in tons:

Bituminous rock	45,526
Oil asphalt	136,204
Gilsonite	20,285
Maltha	13,507
All other kinds	8,339
Total	223,861

Foreign importation in tons:

Crude	142,494
Dried	13,535
Bituminous limestone	4,925
Total	160,954

Of the importations 101,885 tons were from Trinidad.

Advance reports for 1908 show in tons:

Bituminous rock	37,371
Oil asphalt	102,281
Gilsonite	18,533
Maltha	12,875
Total including all other kinds	185,382

Foreign importation in tons:

Total	151,674

Of the importations 98,098 tons were from Trinidad.

There is a notable increase in the production of oil asphalts which is paralleled by an almost proportional increase in the importations of Trinidad asphalt. This increase is all in lake asphalt, for there is a material decrease in the amount of land asphalt imported.

That in the country east of the Mississippi river, and perhaps in all that east of the Missouri river, the proportion of foreign asphalts to domestic asphalts used in pavements is fairly uniform, is a general impression. The states west undoubtedly use a preponderance of domestic asphalt. With allowance for this and for the use of a part of the paving asphalts named in other ways, a rough comparison can be made, which indicates that the proportion of Trinidad asphalt used in pavements is gradually diminishing, and while it may have been 40 per cent, of the total asphalt used in pavements in 1904 it was scarcely 30 per cent. in 1907.

If our readers have any data which will add to the definiteness of this estimate, they are requested to communicate with this department.

Machine for Cutting Asphalt Pavement.

Could you give us any particulars as to where the machine whose description is enclosed is made or as to whom I could write to find out further particulars about it? D. R., Chicago, Ill.

The machine referred to is probably the machine patented by John Gammie, of New York City on Aug. 1, 1905, patent No. 795,905, under the title "Means for Removing Asphalt Paving." Another patent with the same title was issued to the same man Aug. 14, 1906, No. 828,734.

Other patents on the same subject are of an asphalt cutting machine by Henry Schumacher, Buffalo, N. Y., No. 786,522, April 4, 1905; an asphalt cutting mechanism by John C. Mertens, Chicago, Ill., assignor of one-half to Joseph Hanreddy, of Chicago, No. 832,919, Oct. 9, 1906; an asphalt ripper patented by Arthur King, of Chicago, Feb. 11, 1908, patent No. 878,638; a process of removing asphalt pavement, patented by Wm. E. Kerns, Fox Chase, Pa., assignor to the Barber Asphalt Paving Co. of Philadelphia, and the patent drawings show the machine used in the process, patent No. 910,922, issued Jan. 26, 1909; and a pavement cutter patented by Daniel E. Wiseman, San Francisco, Cal., and Fred F. Hedden, Chicago, Ill., on July 20, 1909, patent No. 928,488.

Power of Council to Order Construction of Sidewalks.

In re sidewalks, pleased inform me whether a city council has unlimited power to order construction of walks, charging expense on abutting lots, or to order walks to be laid on one side of the street only, when no petition for walks has issued.
T. M. M., Kissimmee, Fla.

This question must be answered by one familiar with the statutes of Florida, and in particular the charter of Kissimmee. Practice varies much in this respect. In Indiana the board of public works in the larger cities and the city council in smaller cities has the rights mentioned, subject to the right of a majority of the resident property owners to remonstrate against the improvement as a whole and to select the material for the improvement. Most city councils have similar rights, but the procedure prescribed varies greatly in different states. An attorney familiar with Kissimmee and Florida conditions should be consulted as to the exact rights of the council and of the property owners, and as to the proper methods of procedure of either under the Florida laws.

Establishing Grades for Streets, Sidewalks and Curbs.

To the list of books giving information on the above subject which was published in the September number, vol. xxxvii, p. 181, should be added McCullough's "Engineering Work in Towns and Cities" ($3), which was inadvertently omitted. It has much good material to aid in the design of street pavements.

What Is Amesite?

What is amesite, and what is the method of laying it as applied to country roads?
E. L. Z., New York City.

Can any of our readers give us details of this new road treatment? Bids have been received for the construction of roads with this material in New Jersey, but inquiry has not yet brought specifications or information about it to this office.

Is There a Magazine Devoted to Surveying.

Could you tell me of a magazine devoted entirely or party to surveying?
C. L., Park City, Utah.

A Kansas county surveyor began the publication of such a magazine some years ago, but its patronage seems to have been insufficient to sustain it. MUNICIPAL ENGINEERING devotes a share of its space to this subject, and the Question Department is always open to its subscribers who wish to ask questions upon this as well as any other municipal subject if they wish to

know anything which is not given in the current numbers.

Cities Owning Water and Light Plants.

Can you furnish me with a list of ten or twelve cities from 30,000 to 40,000 population which own and operate their own electric light and water plants? Perhaps there are some back numbers of MUNICIPAL ENGINEERING containing articles on this subject that would be of interest.

M. O. S., Chicago, Ill.

The following cities of about the populations named are reported to own both electric light and water plants. Cities of this size apparently find it most satisfactory to operate the plants independently. In a few, notably all the Illinois cities, the electric light plant is for street lighting only.

Hamilton, O., water gas and electric light plants are operated separately.

Aurora, Ill., operates municipal water and street lighting plants.

Kalamazoo, Mich., operates independently its water plant and electric street lighting plant.

Fort Worth, Tex.

Bay City, Mich., operates water and light plants independently.

Jacksonville, Fla., operates its electric light and water plants independently under the management of the same board.

Taunton, Mass., operates municipal water and electric light plants.

Springfield, Ill., operates municipal water and street lighting plants.

Tacoma, Wash.

Galveston, Tex.

Wheeling, W. Va.

Holyoke, Mass., operates municipal water, gas and electric light plants.

In vol. xxxvi, p. 315, and vol. xxxv, p. 35, will be found lists of articles on the subjects of municipal water and light plants. The annual reports of the Massachusetts Board of Gas and Electric Light Commissioners, the New York Commission of Gas and Electricity, and the Wisconsin Railroad Commission, will give much valuable information.

Water Works, Water Supply and Filtration.

As we look through MUNICIPAL ENGINEERING in the news about contemplated work under the heading of water works, we notice towns contemplating water works and towns contemplating municipal water works systems. When you say municipal, do you mean a filtration plant, or only when you say filtration or filter as referred to at several cities? Water works, I suppose, means water supply without first filtering same. If convenient for you, I believe many in business who read your magazine would be glad to know if you mean water works or filtering plants. It would help to know to whom to write.

A. G. G., Red Wing, Minn.

Strictly speaking, the term water supply is applied to the water supplied to the city, and water works is the term applied to the means by which the water is supplied. The terms are often used without distinction, however, especially in the news columns, where nice distinctions of terms are not always carefully made. In the department of "Improvement and Contracting News" in MUNICIPAL ENGINEERING, all the information available is given. In case water works is the term used, the plant may be a municipal plant, that is, owned or proposed to be built by the city, town or village, or it may be of private ownership. In case the term municipal water works is used, the plant is owned or proposed by the municipality. In any case the mayor or the city clerk can give information about the plant or the project. If it is in charge of some particular person whose name is known, the name is given.

Filtration is a method of purifying the water supply to prepare it for distribution through the water works, the filtration plant being a part of the water works plant. Water supplies under both private and public ownership are filtered, and the private ownership may be for service to the public at large or for private service, so that there is no necessary connection between the terms municipal and filtration.

Thus, Columbus, Ohio, owns its water supply, and softens and filters it, and then supplies the water to its citizens through its water works pumping and distribution systems. In Indianapolis, Ind., the supply is also filtered, but the water works system, both supply and distribution, is owned by the Indianapolis Water Company, a private corporation. The city of Chicago, Ill., owns its entire water system, which is not filtered. The water supply of Peoria, Ill., and the distribution system are owned by the Peoria Water Company, a private corporation, and the supply is not filtered. The C., B. & Q. railroad owns a number of private water plants, used only for the supply of its own engines, shops or employes. Some of the supplies are filtered and some of them are not. These plants are larger than some water works for supply of the public, and they require as much attention and as many supplies, but they are in both ownership and service strictly private institutions.

Measuring Water Waste.

I notice an article in the September issue of MUNICIPAL ENGINEERING. on the benefit of meters in the water system in the District of Columbia, and the article makes mention of the use of a pitometer for detecting main leaks. Kindly advise me what a pitometer is, how used, etc.

C. W. R., Supt.,
———, Ala.

The pitometer is an arrangement of Pitot tubes with a recording device to produce a continuous record of flow of water in pipes. The tubes are inserted in the pipes through special connections and the records show by the amount of flow when there should me no draft, what amount is wasted through leaks and open connections. By districting a city and working down in detail the sections showing great waste, the location of leaks and excessive use of

water may finally be located. A large system may be able to save large amounts of water by means of an expert examination of its system with the apparatus. There are other waste water detectors and a small plant can probably produce the desired result by a careful inspection of house plumbing and the use of the aquaphone for serious leaks in the water mains. A full description of the method in use by one water works superintendent, B. L. Williams, Jr., of West Orange, N. J., will be found in MUNICIPAL ENGINEERING, vol. xxxvi, p. 319.

Valuable Data Regarding Water Supplies.

As the question is up here of the improvement of the water works system to a large extent, we wish to secure some information as to the water supply and method of distribution of other cities similarly situated.

Will you kindly furnish us at your earliest convenience a brief statement as to such systems? The following questions may serve as suggestions.

From what source is the water supply secured—wells, river, lake or other?

What is the average daily rate of consumption of water?

What is the daily pumping capacity of the plant?

Is there an artificial reservoir, and if so, of what capacity and of what material constructed?

Is there a filtration system, and if so, of what kind?

Of what diameters are the water mains by which the supply is distributed to the city?

Has the fire department steam engines, or is the dependence on the hydrant pressure?

How many years has the present water pumping apparatus been in use?

Is the plant the property of the city or owned by a private company?

THE PANTAGRAPH, Bloomington, Ill.

Out of the mass of information on this subject which is at hand, the following has been selected, mainly regarding cities of 25,000 to 50,000 population, to show the variations in answers to the questions asked as gathered from the data regarding cities of this size.

Birmingham, Ala., obtains its supply from a river about 8 miles southeast of the business center, with a supplementary supply from a creek nearly the same distance northeast. Its average daily consumption is 5,028,900 gallons, and it is served by 6 pumps of a combined capacity of 38,000,000 gallons a day. Four of these pumps deliver water to reservoir from which the flow is by gravity, and two pump directly into the mains. Besides the dams on the river and creek, with storage capacity of over 200,000,000 gallons, the reservoir for storage and settling has a capacity in its two parts of 149,500,000 gallons. Each of the supplies is filtered, one through 30 mechanical filter units each of 600,000 gallons capacity, and the other through 10 units each of 500,000 gallons capacity. The supply main from the reservoir is 30 inches in diameter, and that from the supplementary pumping station is 20 inches. The city has 6 steam fire engines in service. The pumping engines of the water works have been added from time to time as the plant has grown, the oldest being 21 years old and the newest one year, all being ready for use on demand. The plant is owned by the Birmingham Water Works Company.

Jacksonville, Fla., obtains its supply from 8 artesian wells which discharge into the pump well, a small storage reservoir, or aerating basins, as desired. The average daily consumption is 2,956,200 gallons, which is served by 3 pumps of combined capacity of 11,500,000 gallons a day, all in good condition. The various basins, wells, reservoir and elevated equalizing tank have combined storage capacity of 3,210,000 gallons. All but the steel tank are in excavation lined with brick or concrete. The pipes from the pump to the distribution system are 12, 14, 16 and 20 inches in diameter. The city has two fire engines in service and owns the water works plant.

Pensacola, Fla., is supplied by 12 driven wells about 135 feet deep, 6-inch casings and 4-inch points. The average daily consumption is about 500,000 gallons, and it is supplied by 2 pumps with combined capacity of 4,000,000 gallons a day, used alternately. Two covered aerating reservoirs of brick cemented on inside and two steel standpipes have a combined storage capacity of 903,750 gallons. The service from the pumps to the distributing pipes is by a 14-inch main, which is considered inadequate. The city has one old fire engine in reserve which may not be able to give much service. In case of necessity the L. & N. railroad can supply water through a connection with its fire main system, using salt water. The plant is owned by the Pensacola Water Co.

Tampa, Fla., is supplied by a spring and 13 10-inch flowing wells, aided by air-lift when draft is heavy. The daily consumption is 1,700,000 gallons, supplied by 2 pumps in new station and 3 reserve pumps in old station, with combined capacity of 12,000,000 gallons a day, two-thirds of which is in the new station. An elevated steel tank with a capacity of 110,000 gallons is the only storage. The service to the system of distributing pipes is through a short 16-inch main. The city has 3 fire engines in service. The pumps in the new water works station are 3 and 6 years old, the old pumps 19 years. The plant is owned by the Tampa Water Works Company.

Macon, Ga., gets its supply from a river, using an average of 3,373,160 gallons a day. Two pumps, each 5,000,000 gallons capacity, lift the water to the filters, and two others of 5,000,000 and 6,000,000 gallons capacity, with a third priming pump, supply the distribution system. The pump well has 50,000 gallons capacity, and there is a 2,000,000 gallon distributing reservoir and an 875,000 gallon steel standpipe. The filters are of the mechanical type. The pumps supply the distribution system

through about 4 miles of 20-inch pipe. The city has 4 steam fire engines in service and 1 in reserve. The water works pumps are 6 and 11 years old. The plant is owned by the Macon Gas Light and Water Company.

Peoria, Ill., population about 70,000, is supplied from 7 wells and their auxiliaries, the large wells being some 50 feet deep, with tubes sunk in the bottom 5 to 20 feet deeper. The daily consumption is 6,806,000 gallons, supplied by 3 pumps in the main station and one in a reserve station, with combined capacity of 26,600,000 gallons a day. The reservoir, of 18,000,000 gallons capacity, is of earth with concrete core wall where above the original ground surface. The 2 supply mains from the pumping station and reservoir to the distribution are 20 and 30 inches diameter. The city has 2 fire engines in service and one in reserve. The pumps in the main station of the water works are 7 years old and the reserve station is new. The plant is owned by the Peoria Water Works Company.

Rockford, Ill., is supplied by 11 8-inch artesian wells 400 to 2,000 feet deep, discharging into a shaft under the pumping station. The average daily consumption is 3,555,000 gallons, which is lifted from the shaft to the reservoir by 3 pumps with 5,000,000 capacity each, and from the reservoir to the distribution by 4 pumps with a combined capacity of 21,000,000 gallons a day. The reservoir is largely in excavation, with concrete walls, faced with brick on outside above ground surface, and with reinforced concrete roof, capacity 1,250,000 gallons. Distribution system is served by 4 short mains from pumping station, 12, two 16 and 20 inches diameter. The city has 4 steam fire engines and 1 gasoline automobile engine. The water works pumps are from 2 to 34 years old. The city owns the plant.

Springfield, Ill., pumps its supply from a river, using infiltration galleries to some extent, and has a new dam giving increased head on them. The daily consumption is 4,738,000 gallons, which is supplied by 2 pumps with total capacity of 12,000,000 gallons, with a reserve pump of 3,000,000 gallons capacity in old pumping station. A 4,000,000 gallon reservoir, earth embankments, is not used. The supply mains from pump to distribution system are 15 and 24 inches diameters, each 2 miles long, and are considered insufficient. The city has 3 fire engines in service and one in reserve. The water works pumping engines are from 11 to 33 years old. The city owns the plant.

Anderson, Ind., obtains its supply from White river. The daily consumption of 5,000,000 gallons is supplied by 2 pumps of 8,000,000 gallons capacity pumping to the filters, and 2 of 6,000,000 gallons pumping to distribution. Mechanical filters are in use. The mains supplying water to the distribution system are 16 and 20 inches in diameter. The city has no steam fire engines and owns the water works plant.

Fort Wayne, Ind., obtains its supply from wells or filter galleries by pumping. Its daily average consumption is 5,131,833 gallons. The supply mains are 20 and 24 inches in diamter and the city owns the plant. The city has 7 steam fire engines in service.

Indianapolis, Ind., population 250,000, obtains its supply from a river, and has also a system of 33 deep wells which can be used on occasion. The daily consumption is 18,114,219 gallons, which is supplied by 6 pumps with total capacity of 78,000,000 gallons a day. There are 2 covered concrete clear-water basins at filter plant and a large covered concrete reservoir at pumping station. Service is by gravity from canal through filters and 48-inch reinforced conduit to the reservoir, with emergency pumping plant of 20,000,000 gallons capacity from Fall creek to filters. Slow sand filtration. There is a 30-inch gravity conduit from reservoir to lower pumping station. Distribution pipes are served by 36 and 24-inch supply mains from upper station and 24 and 20 from lower. City has 11 fire engines in service. Pumping station engines are from 4 to 34 years old. Plant is owned by Indianapolis Water Company.

Muncie, Ind., obtains its supply from river, creek and 18 wells. The daily consumption of 5,300,000 gallons is supplied by 7 pumps with 20,000,000 gallons daily capacity. The clear-water basin of the mechanical filter has a capacity of 100,000 gallons. The supply mains from 2 pumping stations to distribution are 16 and 12 inches in diameter. The city has one steam fire engine in reserve. The water works pumps are 3 and 18 years old. The plant is owned by a company.

South Bend., Ind., obtains its supply from 63 flowing artesian wells. The daily consumption of 4,064,529 gallons is supplied by 5 pumps with a total capacity of 12,000,000 gallons a day. There is a covered reservoir with 320,000 gallons capacity, also a standpipe with 30,000 gallons capacity. The supply mains are 20 and 24 inches in diameter, the main pumping station being near the center of the distribution system. The city has no steam fire engines. The city owns the plant.

Newport, Ky., obtains its supply from the Ohio river. Its daily consumption of 1,843,000 gallons is supplied by 2 pumps. The reservoir is formed by a dam. The supply main is 20 inches in diameter. The plant is owned by the city.

(Information about other cities will be given in the November number.)

FROM WORKERS IN THE FIELD

Practical Points from Practical People.

Contributions to this Department are invited. Give from your experience for the benefit of others. No matter about the style of the composition, the fact is what is wanted. Use the Question Department for what you want to know; use this Department for what you can tell others.

Form of Meter Repair Record.

To the Editor of MUNICIPAL ENGINEERING:

Sir: In your issue of September, on page 183, we find an inquiry for a form of meter repair record.

In our city water works department the meters are owned by the city, and when repairs are needed the cost of same is entered against the meter maintenance from reports issued by the repair man upon the accompanying blank form.

Where the cause of repair is due to neglect or abuse by the consumer or propty owner the cost is taxed against him at the time of rendering regular water bills.

The reports are made out and numbered consecutively by the meter repair man and kept on file for reference in the office.

K. C. KAASTBERG,
City Engineer and Superintendent Water Works, Boone, Iowa.

REPORT OF METER REPAIRED. No.

Service No. ____ Meter No. ____ Size No. ____ Make ____

Owner ____ No. ____ Street ____

Time Taken Out ____ By ____ Meter Reads ____

Date Connected ____ By ____ Meter Reads ____

Cause of Repairs Needed ____ COST OF REPAIRS $ ____

$ ____

$ ____

$ ____

$ ____

Total $ ____

Repaired by order of ____ SUPT. OR WATER WORKS.

I hereby certify that when the above meter was connected it was in good running order and tested ____ 19__

INSPECTOR.

Boone, Iowa, ____

Forms of Meter Repair Records.

To the Editor of MUNICIPAL ENGINEERING:

Sir: In reply to W. J .S., —, Ill., as to forms for keeping meter repair records, I enclose herewith a meter repair report which formerly was used in our meter department. While we found this would cover our needs, at the same time the danger of losing or mislaying individual reports was so great that we had our meter repair report put in book form, and I enclose ruling for same herewith.

This latter record is made in duplicate, the original record being made by the meter repair man in the shop, and at the end of each month the record is copied into a permanent repair record in the office.

WILLIAM H. BLAIR,
Superintendent the West Orange Water Co., West Orange, N. J.

WEST ORANGE WATER CO.

METER REPAIR REPORT.

Mr. John Doe
No. 14 Chestnut

Service No. 23 Aug 20 1909

Meter No. 160886
Size 5/8 Make Crown
Why removed By request
Repaired as follows:—

~~Runner~~ Spindle screw	07
Upper Shell Gasket	02
Train gear.	
Packing Box	09
Glass	
2 Tests Four $	
Replaced by 5/8 Crown #76706	
Reset Ore Rand Mfg	
W. C. Beasley Inspector.	20
	29

HEADINGS AND RULINGS FOR METER REPAIR RECORD BOOK, WEST ORANGE, N. J., WATER COMPANY.

(Left Hand Page.)

TESTING RECORD.

Date.	Meter.			Index Beginning of Test.	Index End of Test.	Diff. cubic feet.	Tank cubic feet.	Per Cent.	Condition.
	Size.	Number.	Style.						
1909									
Aug. 30.	¾	160806	Crown.	89600	89609.98	9.98	10	2	¾ stem. Slow.
" "				89609.98	89609.99	9.99	10	1	1/8 " "
" "	⅝	32305	Trident.	42620	42630	10.	10	....	O. K.
				42630	42631	1	1	....	O. K.

(Right Hand Page.)

REPAIR RECORD.

Inspection Record Page.	Meter Removed From				Cost.				Remarks.
	Ser. No.	Name.	No.	Street.	Repairs.		Labor.		
110	23	John Doe.	14	Chestnut.	$	09	$	20	Cleaned, painted, 7 piston screws, 7c.: gasket, 2c.
110	17	M. Macmillian.	61	Valley Way.		40		20	Cleaned, gasket, 5c.; frost bottom, 35c.

Indianapolis Specifications for Bituminous Macadam Pavement.

1. Portland Cement Concrete Base: Upon the sub-grade, the concrete foundation prepared according to the specifications for "Concrete, Broken Stone and Rolled Gravel Foundations" (Form "M"), except that the concrete shall be so mixed that the top surface shall be rough, shall be spread a thin coat of hard bituminous cement, covering the entire surface. The surface of the concrete must be thoroughly dry and shall be coated just in advance of laying the wearing surface thereon. The coated concrete surface shall be kept as far as possible free from dust or dirt.

2. Wearing Surface: Upon the rough surface of this coated concrete foundation shall be laid a wearing surface which shall be composed of carefully selected, sound, hard, crushed stone and sand mixed with bituminous cement and laid as hereinafter specified. After thoroughly heating and drying the stone and sand to not less than 225 degrees Fahrenheit nor more than than 250 degrees Fahrenheit, this mxture of stone, graded and secured as described in paragraph 3, and sand, shall pass into an approved form of mechanical mixer and while in this mixer, a sufficient quantity of bituminous cement having properties hereinafter described shall be added to thoroughly coat all particles of stone and sand and to fill the voids of the sand and stone completely. The bituminous cement, before mixing, shall be heated to 250 degrees Fahrenheit. The amount of bituminous cement to be used in each batch shall be accurately determined, and the mixing shall be continued until a uniform bituminous concrete is obtained. The mixture shall be hauled to the street and there spread on the coated concrete foundation to such depth that after thorough compression with a hand roller and steam 10-ton asphalt roller it shall have a thickness of two inches. The top surface of the wearing surface shall be smooth and a sufficient amount of bituminous cement shall be used in this wearing surface so that by rolling a smooth surface shall be obtained. Any unevenness or honeycomb appearing on the surface, such parts may be ordered removed and replaced by a dense bituminous concrete mixture, if the Board of Public Works shall so direct, or a thin coat of bituminous flush coat cement may be used to fill such unevenness of surface or honeycomb. A thin layer of screenings shal be rolled into the top surface.

3. The proper proportions of the ingredients composing the wearing surface shall be determined in the manner described herein:

Clean, hard limestone, trap, granite, or other hard stone, which by its nature is suitable for the construction of macadam roadways, and which has heretofore been used for that purpose shall be assembled in sharp fragments of varying size, the largest being from one inch to one and one-half inches in diameter, and in such proportions that the coarser fragments are in the majority and the voids, carefully determined, do not exceed 25 per cent.

when the stone is dried and thoroughly compressed.

There shall then be calculated the amount of a finer mixture prepared from sand, dust and bituminous cement, which shall be slightly in excess of the amount required to fill the voids in the stone. The quantity of the different ingredients necessary to produce this mixture, together with an additional amount of bituminous cement sufficient to coat the particles of broken stone hereinbefore referred to shall be definitely determined. The quantities of the different ingredients so determined together with the broken stone, shall thereafter be used as a formula for the preparation of the bituminous wearing surface.

4. Bituminous cement: The bituminous cement shall in each case be free from water, petroleum oil, water gas, or process tars, and shall be especially refined with a view of removing light oils, naphthalene, and other crystalline matter subject to atmospheric influences. At least 90 per cent. of the constituents shall be obtained from the distillation of coal tar. The bituminous cements used in the foundation wearing surface and top coat shall be such as are especially prepared for the purpose for which they are to be used, and shall be brought to the consistency best suited to withstand traffic and climatic conditions and to insure their ready union with the sand and stone. The cement shall be uniform in quality and must be unaffected by water.

Bidders shall submit samples of the bituminous cements proposed to be used in the foundation, wearing surface, and flush coat, also samples of the broken stone to be used in the wearing surface. Samples submitted shall be left in the office of the Board of Public Works, at or before the hour set for opening bids. Not less than one-half gallon of each kind of bituminous cement shall be filed.

The Board of Public Works will refuse to consider any bid unless such samples are filed.

5. The successful bidder must show to the satisfaction of the Board of Public Works that he can secure a sufficient quantity of bituminous cement having the same chemical and physical properties of the samples filed and accepted, and he shall also show to the satisfaction of the Board of Public Works that he has or will, within thirty days after the award of the contract, have the necessary machinery for securing a uniform mixture of stone of different sizes as provided for in paragraph 3, and for properly mixing the bituminous concrete for the wearing surface.

6. Additional bond: In addition to the twenty cents per square yard retained by the city as provided for in Section 38 of the "General Specifications," the successful bidder must execute a bond for maintenance of such work and indemnifying said city from liability for any violation of letters patent or copyright by such bidder.

Rental of Machinery Upon Municipal Day Labor Work.

In the study of the efficiency of work done by day labor in Boston, Mass., by Messrs. Metcalf & Eddy, of that city, consulting civil engineers to the late Boston Finance Commission, the fact was revealed that it was customary for the sewer department to rent the machinery used upon its work. Their report, recently published, discusses the basis upon which such rental should be charged.

It is frankly stated by the engineers that it is somewhat difficult to determine what is a fair rental for machinery upon this class of work. It not infrequently happens that such machinery is abused by those operating it, and it is also at times injured when being moved, and in cold weather it is liable to be damaged by freezing of water in pipes and boilers. The owner must take all of these conditions into consideration in fixing his price. There are, however, a few firms which make a business of building and renting machines, and in fixing the fair rental prices herein presented. The charges made by some of these companies have been taken into consideration. In view of all the circumstances, it does not appear that a rental amounting to 5 per cent. of the first cost of the machine for each month's use is unreasonable, although at first glance it appears to be very high. The rates which have been charged the city, and the rates which the engineers consider to be fair, are given in the accompanying table, somewhat abbreviated. It will be observed that the amounts charged are in many cases very greatly in excess of the rates stipulated as fair. It would seem that a rental rate which would pay the entire cost of the machine in twenty months was as high as ought to be charged, especially

in view of the fact that some of the machines were used for long periods of time.

By proper arrangement the number of machines required might have been reduced. The total amount of money required for the purchase of these machines would have been about $35,000, whereas the city actually paid about $32,000 as rental during nineteen months. It would therefore have cost the city only $3,500 more to purchase an equipment sufficient to do this work. In the cases of hoisting engines, tubs and buckets, scale boxes, pumping engines, pumps, and pumping engines including pumps, the city has paid considerably more during the period under consideration than it would cost to buy a new equipment.

Assuming that $35,000 would furnish a suitable equipment, the annual cost can be figured on a basis of 4 per cent. or $1,400 for interest, and 10 per cent. or $3,500 for depreciation, which would amount to about $5,000 per annum. Based upon an average monthly rental of $1,690, the city paid during the nineteen months an annual rental of over $20,000. Thus it would ap-

pear that if the city owned its own equipment, a saving of about $15,000 per year could be realized.

They recommend that:

1. The city adopt the policy of owning its own machinery.

2. If it becomes imperative to rent machinery, the rate of rental should in no case exceed 5 per cent. of the first cost of the machine, per month.

RATES CHARGED AND FAIR RATES FOR USE OF MACHINERY.

	Rentals Actually Charged			Fair Rental per Month 5 per cent. of Cost
	Day	Week	Month	
Carson Trench Machine Co.				
Tubs	.....	.....	$3.00	$1.40
Trench machine No. 196 and engine, single upper track, 6 traveler	.....	.....	170.00	165.00
Margaret M. Hickey.				
Engine and derrick	$5.00*	.....	130.00	85.00
Double hoisting engine	3.00*	.....	78.00	60.00
George W. Judd.				
No. 1 cableway and engine	.....	.....	200.00	162.50
No. 3 bull wheel derrick and engine	.....	.....	150.00	85.00
No. 2 Carson trench machine	.....	.....	200.00	165.00
Iron scale box	0.50**	.....	15.00	4.90
D. Henry Cram.				
Bull wheel derrick, swinging gear, 3-drum engine	.....	.....	150.00	85.00
Scale box	0.50*	.....	13.00	4.90
Tubs (large)	0.25*	.....	6.50	1.40
Daniel Marr & Son.				
Derrick and engine	.....	$21.00	90.00	85.00
Carson machine buckets	.....	1.50	6.43	1.40
H. H. Carter.				
No. 2 cableway and engine	.....	.....	200.00	162.50
20 h. p. pumping engine	3.50**	.....	105.00	36.25
Iron scale box	0.50**	.....	15.00	4.90
No. 6 pulsometer, with fittings complete	1.50**	.....	45.00	17.50
No. 2 bull wheel derrick and engine	.....	.....	150.00	85.00
Metropolitan Contracting Co.				
No. 2 Carson trench machine, without engine	.....	.....	150.00	110.00
15 h. p. pumping engine and 6-inch centrifugal pump	5.00**	.....	150.00	53.75
25 h. p. pumping engine, 8-inch centrifugal pump	5.50**	.....	165.00	53.75
20 h. p. pumping engine, 6-inch centrifugal pump	5.00**	.....	150.00	53.75
No. 3 cableway and engine	.....	.....	200.00	162.50
No. 2 bull wheel derrick and engine	.....	.....	150.00	85.00
Iron scales (boxes)	0.50**	.....	15.00	4.90
6-inch centrifugal pump, with fittings	2.50**	.....	75.00	17.50
Large derrick and engine	.....	.....	100.00	85.00
William Droyer.				
Platform derrick and Lidgerwood engine	6.00**	.....	180.00	85.00
Buckets	0.40**	.....	12.00	1.40
Buckets	0.25**	.....	7.50	1.40
Carson cable machine	.....	.....	200.00	162.50
Pump	1.50**	.....	45.00	17.50
Hoadley pumping machine	3.00**	.....	90.00	36.25
Centrifugal pump	1.50**	.....	45.00	17.50
Pulsometer	.....	.....	46.50	17.50
Large derrick and Lidgerwood hoisting engine	.....	.....	200.00	5.00

*Days working.
**Every day.

MUNICIPAL MATTERS IN COURT

Higher Courts—Pavement Enjoined.

Decisions of the Higher Courts of Interest to Municipalities.

BY JOSEPH W. KENNEY, ATTORNEY, INDIANAPOLIS, IND.

Statute Abrogating Municipal Ordinances.—Act July 1, 1907, regulating automobiles and motor vehicles within the state, designed to suspend all municipal ordinances or rules regulating the equipment and operation of motor vehicles, and hence abrogated all municipal ordinances designed to regulate their use, and deprived municipalities of the right to pass regulating ordinances in the future.—Ayres v. City of Chicago (Ill.), 87 N. E. 1073.

Conflict Between Statute and Ordinance.—Where there is a conflict between the statute and an ordinance, the ordinance must yield if it be necessary to hold either invalid.—Mantel v. State (Tex.), 117 S. W. 855.

Regulation Limiting Height of Sign Boards—Invalid.—Building Code of the City of New York (Sect. 144), defining sky signs and providing that they shall not be at any point over nine feet above the front wall or cornice of the building to which they are attached, is an improper exercise of the police power, it not being drawn to protect the public health, morals or safety, and arbitrarily prohibiting an advertisement without prohibiting any other structure of an equal or greater height.—People v. Murphy (N. Y.), 88 N. E. 17.

Street Lamps and Poles—Public Use of Streets.—Where street lamps and poles of public service corporations had been in existence for a long time on a strip of land claimed to be embraced in a public street, the city will be held to have acquiesced in such public use of the strip, whether they were so placed in strict accordance with city charter regulations or not.—Benton v. City of St. Louis (Mo.), 118 S. W. 418.

Tax Can Only Be Made for Debt Certain and Definite.—General Municipal Law, (Laws 1892, p. 1734, c. 685, section 5), providing that an ordinance of a municipal corporation creating a funded debt shall provide for the raising annually by tax a sum sufficient to pay the interest and principal, is not applicable to a resolution adoped by the taxpayers of a village for the purchase of a waterworks system, for a provision for a tax can only be made for a debt certain and definite.—Village of Waverly v. Waverly Water Co. (N. Y.), 87 N. E. 1129.

Vacation of Street by City—Title to Land.—On the vacation of a street by a city the title to the land reverts to the owner of the fee whether the fee is in the city or an adjoining owner.—Knight v. Thomas (Utah), 101 P. 383.

Removal of Building in Street—Adverse Possession.—Evidence of ten years' adverse possession of land by one in plaintiff's chain of title and of plaintiff's possession for more than ten years is sufficient evidence of title to enable plaintiff to maintain an action for the removal of a building in the street, obstructing the entrance to such premises.—Bruner Fire Co. v. Payne (Tex.), 1185 S. W. 602.

Statutory Authority Necessary for Grant of Franchise.—In the absence of statutory authority, a city has no power to grant a franchise to construct a gas plant for furnishing light, fuel and power, and to pipe the streets for distribution of gas to customers.—Elizabeth City v. Banks (N. C.), 64 S. E. 189.

Exercise by City of Power of Eminent Domain.—A municipal corporation cannot exercise the power of eminent domain unless expressly authorized by the Legislature.—Gasaway v. City of Seattle (Wash.), 100 P. 991.

Amendment of Ordinance Granting Franchise to Street Railway Co.—An original street railroad franchise required the company to keep the street occupied by its tracks in good condition and to keep that portion of the street lying between the ends of its ties in good repair. An amendatory ordinance subsequently passed covering the entire subject required the railroad company to maintain the track, so that the rails and ties would not interfere with public travel more than was reasonably necessary and also not to interfere with crossing or driving on the track by vehicles, omitting, however, any agreement by the railroad company to pay for the improvement of that portion of the street lying between the ends of the ties. *Held*, That the new ordinance repealed the old one, and extinguished the railroad company's obligation to keep the streets in repair between the ends of the ties.—Indianapolis & E. Ry. Co. v. Town of New Castle (Ind.), 87 N. E. 1067.

Contract for Supplying Water to Municipality—Damages for Breach.—A city and any of its inhabitants on one side, and a water company, on the other, are entitled to such damages resulting to them from a breach of the contract between the city and the company as are fairly

within the contemplation of the parties, either expressly provided by the contract or fairly implied therefrom.—Ancrum v. Camden Water, Light & Ice Co. (S. C.), 64 S. E. 151.

Construction of Street Railroad Co.'s Franchise.—The grant of a right to construct and operate a street railroad must be construed most favorably to the public. —City of New York v. New York City Ry. Co., 87 N. E. 1117.

City's Improvement of Water Plant and Sewerage System Before Paving Streets. —Whether a city should improve its water plant and put in a sewerage system before paving its streets was a matter within the discretion of the city council, over which the courts had no control. (Swan v. City of Indianola [Iowa], 121 N. W. 547.)

Void Contract for Repair of Streets—City's Liability.—Where a municipal corporation by contract obtained the use of an asphalt plant to repair its streets, and in making the contract the provisions of the city charter were not complied with, and the contract was therefore void, it was liable for the value of the reasonable use of the plant while making repairs. (Nebraska Bitulitic Co. v. City of Omaha [Neb.], 121 N. W. 443.)

Power to Construct a Sewer.—The power to construct a sewer along a public street in the city of Chicago is vested in the city, and not in the Sanitary District of Chicago. (City of Chicago v. McChesney [Ill.], 88 N. E. 560.)

Construction of the Term "Grade."—The term "grade" in the statute relating to grade separations, refers, not only to those established by engineers and municipalities, but also to the grades of highways and streets as in common use. (City of Detroit v. Snyder [Mich.], 121 N. W. 258.)

Abutter's Right to Compensation for Removal of Bulkhead.—An abutter who places in the street, after the public rights in the street have been acquired, a bulkhead to protect his property from the flow of water is entitled to compensation for its removal, though the city had a right to remove it. (Fifty Associates v. City of Boston [Mass.], 88 N. E. 427.)

Damages to Abutter for Settling of Building.—Where, by virtue of St. 1894 (p. 772, c. 548, sec. 34), as amended by St. 1895 (p. 486, c. 440, sec. 1), giving abutting owners compensation for all damages sustained by the construction of a subway, the abutter is entitled to recover for the physical injury done his building by the settling thereof, the expense of paying a competent person to see that proper precautions were taken to make the physical injury as small as possible is properly included.—Idem.

Indebtedness of City No Ground for Enjoining Letting of Street Contract.—That a city was indebted to its constitutional limit was no ground for enjoining the letting of a street contract. (Swan v. City of Indianola [Iowa], 121 N. W. 547.)

Paving Contract Obtained Through Fraud—No Recovery.—Where a municipal street paving contract has been obtained through fraud, no recovery against the property owners assessed could be had on a quantum meruit, and they would also be entitled to defeat the levy of any tax to pay the contract price. (Idem.)

Assessment Upon Burial Lots Illegal.—Laws 1879, p. 397, c. 310, provides that no land occupied for cementery purposes shall be sold under execution for any taxes or assessments, nor shall any tax or assessment be imposed thereon. Held, That a rural cemetery association can not be assessed for a sidewalk along lands used by it exclusively for cemetery purposes which have been plotted for burial lots and sold for burial purposes, and the assessment thereon is illegal and void. (Gouverneur Village v. Gouverneur Cemetery Ass'n [N. Y.], 116 N. Y. S. 1107.)

Taking of Junket by Members of Council Not Fraud in Obtaining Contract.—Fraud of members of a city council, justifying an injunction against a street paving contract, was not shown by proof that members of the council took a junket on the invitation of the agent of the successful bidder, and at its expense, where such bidder had no monopoly of the materials or supplies and was the lowest bidder for the work among several other concerns, who were given equal opportunities to obtain the contract. (Swan v. City of Indianola [supra.])

City Not Liable for Illness from Pollution of Stream by Sewer.—The maintenance of a free public sewer system by a city is an exercise of its police power for the public benefit, so that a city would not be liable for the death of a citizen from illness caused by the pollution of a stream by the sewer which emptied into it. (Metz v. City of Asheville [N. C.], 64 S. E. 88.)

Public Nuisance Maintained by City.—A municipal corporation has no legal right to establish and maintain a condition which creates a public nuisance per se, injuring the health and lives of the people. (Jones v. Town of North Wilkesboro [N. C.], 64 S. E. 866.)

Insufficient Water Supply from Municipal Plant.—A city owning its own water works is not liable for failure to furnish sufficient water supply to extinguish a fire. (Greenville Water Co. v. Beckham [Tex.], 118 S. W. 889.)

City's Liability for Negligence of Officers—Public and Private Lighting.—A municipality in furnishing electric light for lighting its public streets, public places and buildings, is not liable for the negligence of its officers, agents and employes; but in furnishing electric light for private purposes to its inhabitants for remuneration, it is liable for such negligence. (Hodgins v. Bay City [Mich.], 121 N. W. 274.)

Dead Limb Falling from Tree Upon Street—City Not Liable.—Under Compiled Laws, sec. 3441, an act providing for the

recovery of damages for injuries caused by reason of defective streets and highways and sidewalks, and sec. 3443, making it the duty of cities to keep streets, sidewalks, etc., in reasonable repair so as to be reasonably safe for public travel, it was held that the act was intended to require the maintenance of the physical surface of the state's highways in a reasonably safe condition against accidents from failure to do the things required by statute, and not those due to extraneous causes; and hence there could be no recovery against a city for an injury caused by a falling dead limb from a live tree in the street between the sidewalk and the curb. (Miller v. City of Detroit [Mich.], 121 N. W. 490.)

Injury from Ice Upon Street—Liability.—If a city negligently allowed water from a broken main to escape into the street, which formed ice that remained so long that the city had sufficient notice to have repaired the condition, it would be liable for an injury therefrom. (Town of Belleview v. England [Ky.], 118 S. W. 994.)

Pavement Enjoined Pending Information on Validity of Petition.

An opinion handed down by Judge Fuller, August 23, in the case of Richard Scott and others against the borough of Sugar Notch, Pa., its burgess and town council, enjoins the defendants from paving Main street. He says:

That the defendants be restrained from actually increasing the debt or borrowing money under authority of the election until it shall be shown to the court that the paving or macadamizing of the street in question has been petitioned for by two-thirds of the owners of property representing not less than two-thirds in number of feet of the properties fronting or abutting on said street, and thereupon that the injunction be dissolved.

That final disposition of the costs shall be postponed until the final disposition of the case as above suggested.

HIGHWAYS

Concrete Culverts—Automobiles and Roads.

Concrete Culverts for Arkansas Roads.

Road overseers in Greene county, Arkansas, were recently instructed by Judge Light to build no more wooden culverts in that county, but in future to use concrete in their construction. The concrete culverts in the county have convinced Judge Light that this material is not only the cheapest, but the most lasting and durable.

Effect of Automobiles on Roads Shown by New Jersey Tests.

Tests, to ascertain exactly what effect speeding automobiles have on a thoroughfare, were held in Glen Ridge N. J., September 17. County Engineer Owen concluded that the automobile does not have the same effect in tearing up the roadbed that a slow-moving wagon does. He declared that an oil-treated surface stood the strain best, although ordinary telford, which had been uncared for, and a stretch with a clay top dressing, showed not the slightest signs of a break after high-speeding cars had passed along.

Cars ranging in weight from a ton to 3,800 pounds were driven at speeds between ten and sixty miles an hour, and the weight of the car, its speed and its position on the road, were all considered in County Engineer Owen's estimate of the result, which is as follows:

It was apparent that automobile traffic at low speed is not detrimental to a macadam surface, as the tires merely compress the road. The limit of speed where no effect is observed is between twenty and twenty-five miles an hour. At a higher speed stripping action begins, and with continuous stripping the loosening tendency is inevitable. Dust-raising, of course, is a sequence.

The stripping effect is reduced if a clay packed surface is used, but the dust is still objectionable. An oil-treated surface practically eliminates dust and a continually good surface is maintained.

The wear and shattering of the surface of macadam roads is not due alone to the automobile, but to the combination of this class of traffic with horse-drawn vehicles. The roads of the future which are to take this travel and the methods of road maintenance of the future must be adapted to this end and with this in view.

After the automobiles had finished speeding on the road, five heavy coal wagons were drawn over the highway to ascertain the effect of this sort of traffic. According to the county engineer's notations, the result showed that the hammering of the horses' calked shoes and the action of a wide iron-tired wagon tended to bring about a complete breaking up of the road. Large stones that were undisturbed by the autos were displaced by the horses and wagons.

There was no tendency for the clay-packed surface to break up under high-speed autos., but merely to shed the dust from the surface and scatter it according to the direction of the wind.

The results of these tests were not in accordance with the general expectation or accepted opinions. Instead of the high speed breaking up the surface and

scattering the loosened particles, no such results were noted. The dust that had accumulated was in all cases the only medium distributed.

While the autos were traveling at twenty miles an hour or less, nothing could be noted in the effect on the road which would result in injury. Traveling about twenty miles an hour and up to thirty miles, the cars began to grasp the road material instead of compressing it, and at thirty miles an hour the wear of the car wheels became apparent and small particles were carried from their place, though the effect could not be considered dangerous to the welfare of the road. At higher speed the road surface was stripped bare of dust. Traveling at high speed on the oiled section the autos caused only a little suction and raised very little dust.

Mr. Owen's figures on the results of autos traveling at varying speeds are as follows:

For Telford Surface—Ten miles an hour, no trace left in center, compression of dust at side; twenty miles an hour, the surface dust spread sideways, but no stripping; thirty miles an hour, surface dust begins to strip; forty miles an hour, surface under tire swept bare; forty-five miles an hour, dust lifted, surface stripped, but no breaking; fifty-five miles an hour, road stripped bare, but no breaking; sixty miles an hour, road stripped bare, but no breaking.

Oiled Road—Thirty miles an hour, heavy oiled dust raised about one foot; forty miles an hour, heavy oiled dust raised about one foot; sixty miles an hour, strips dust. The high speed on the oiled road had no effect on the surface, either by loosening it or scattering the particles sideways.

Clay-packed Surface—Fifteen miles an hour, compression only; twenty miles an hour, dust raised; thirty-five miles an hour, heavy dust raised, no breaking; forty-four miles an hour, heavy dust raised, no breaking; fifty-two miles an hour, heavy dust raised, no breaking.

Where the tests were held the roadbed is about eight inches deep, of which the surface coating, originally three inches thick, was reduced to about two inches. The road has not been repaired for three or four years. No attempt had been made at dust-laying—in fact, the avenue was purposely neglected for the tests. The effect of the continuous automobile travel of recent years was to lay the center completely bare of the dust covering and loosen the smaller stone. Few large ones were displaced in a length of half a mile. The dust covering which accumulated on the sides was packed down fairly hard and smooth. In a stretch of half a mile only slight abrasion was apparent.

Three kinds of roads were utilized for the tests. One was a strip of telford, which had been without treatment for about a year and a half, but which was in excellent condition; another was a stretch with a top dressing of clay, and the third was oiled road. The application of oil to this third section was made about two months ago. All three kinds of road joined and made a level, straightaway course of about a mile.

Beginning with lightweight cars at slow speed and continuing until the large type of racing car was travelling over the course at express speed, the autos were run over the road, County Engineer Owen noting the weight of each machine, the speed at which it was traveling and the effect on the road.

Eleven automobiles were used. Some were run side by side at speeds ranging from twenty to forty miles an hour, to determine the effect on the edges of the road in a race between machines. It was apparent that this was more wearing on the surface than a single car traveling at higher speed in the center. This was due to the fact that the edges of the road afforded less compact resistance to the tires.

MUNICIPAL AND TECHNICAL LITERATURE

Trenton Sewage Disposal—New Publications.

Report on Sewage Disposal for Trenton, N. J.

A special committee, of which Alfred C. Gregory, engineer of sewers, is secretary, has made a report recommending septic tanks and sprinkling filters for the purification of the sewage of Trenton, N. J., in which the general systems of sewage purification are briefly stated and short descriptions are given of the systems in use at Providence, Worcester, Brockton, Saratoga, Ballston Spa and Reading. Some extracts from the report will be printed later.

New Publications.

Masonry Construction. A guide to approved American practice in the selection of building stone, brick, cement, and other masonry materials, and in all branches of the art of masonry construction. By Alfred E. Phillips and Austin T. Byrne. Cloth, 128 pp. $1. American School of Correspondence, Chicago, Ill.

This is one of the books in the series prepared for the use of the correspondence school which publishes them and like the others is a brief statement par-

opposed to that of the author. Abuse of subject of masonry construction. The sub-title quoted above describes about one-third of the book. Making and depositing concrete, foundations, cofferdams and footings are also briefly described, and about one-third of the book is devoted to stone masonry, including brief treatment of preparation of stone, kinds of masonry, walls, arches, abutments, piers, culverts, etc. The book is apparently well designed to meet the needs of the school and forms a good introduction to the external side of the subject. Little or no theory is included, as this is foreign to the purpose of the book, and consequently the treatment does not cover to any appreciable extent the design of masonry structures nor the more complicated parts of the "art of masonry construction."

The New Building Estimator; a practical guide to estimating the cost of labor and material in building construction from excavation to finish; with various practical examples of work presented in detail and with labor figured chiefly in hours and quantities. A handbook for architects, builders, contractors, appraisers, engineers, superintendents and draftsmen. By William Arthur. 424 pp. cloth, $2.50. David Williams Co., New York.

This is the fifth edition, revised and much enlarged, of a book which has been growing for the past five years. This edition has been put in shape by an experienced publisher, and is apparently well arranged for ready reference, and has a full index.

The author is an experienced contractor and estimator who has put into book form the matters which have been of value to him in his work, and in shape to be of value to others in the same line.

One excellent feature is the use of direct measurements in pounds and in feet and yards, linear, square or cubic, with no special weights or measures and no "customary" methods of measuring or estimating weights, except the number of bricks n a cubic foot of wall. The reductions in cost of stone work on account of machines, the new cements and plasters, the advances in all lines have been taken into account, and the old books in the same line have been discarded. Corrections to former editions are carried forward, making the subsequent editions more reliable.

The introductory chapter contains some valuable instructions in making estimates and bids.

The chapter on approximate estimating gives prices and effects of differences in prices on the most important parts of a building, from the estimator's standpoint, in tabular form, with examples of methods of combination. Various classes of buildings are differentiated, so that a fair estimate of the cost of the ordinary buildings can be made quite readily.

The following chapters take up detailed estimates, covering excavation and filling, particularly of the practical side of the piling, concrete, stonework of various kinds, brickwork in great detail, municipal work of paving, sewers, culverts, arches, etc., fireproofing, tile, reinforced concrete, cement stone, plaster, carpenter and joiner work with laborers' times for all kinds of detail, material and methods of applying, millwork, glass, structural steel and iron, hardware, prices in Chicago market of special materials; details of various kinds of roofing, painting, plumbing and gas fitting, heating and lighting, tiling, cost of buildings per square foot and per cubic foot, railroad buildings of all kinds, engine houses in special detail, standard sizes and grades for stone, lumber, brick and cements, and a chapter of odds and ends.

One chapter gives hints on house building for owners, and one gives the author's ideas on a house, its fittings and cost. There are the usual tables of weights and measures and wages.

The book closes with fourteen numbered photographs of various classes of buildings, the numbers in the estimates in the various chapters referring to these pictures, so that the reader can see what the work is which is detailed in the statements of cost.

The reviewer is not sufficiently expert in building details to be able to criticise the many figures and statements given, but they are given in sufficient detail of quantities, qualities, unit prices and labor to make it possible for an estimator or contractor to apply the data given to his particular case.

Cement Pipe and Tile, advantages of cement for pipe and tile, methods of manufacture, cost, etc. By E. S. Hanson. 110 pp., cloth, $1. The Cement Era Publishing Co., Chicago, Ill.

The cement tile industry is young as yet, and really not out of the experimental stage, so far as the proper combination of quality, quantity and economy is concerned. Good pipes are made, some machines are rapid, and some pipes are cheap, but the combination of the three is not often to be found. Mr. Hanson's compilation is successful in giving a good idea of the present status of the industry of making what may be classed as cement tile. While cement pipe, plain and reinforced, are included in the text, as well as in the title, the treatment is not so full nor so satisfactory.

The first chapter is a statement of the drainage problem in brief. The second chapter states the advantages of cement pipe and the fourth the disadvantages of clay tile. These two chapters, as well as the third on the chemical action of cement in the soil, would carry more weight if they showed less bias in favor of cement and gave dispassionate statements of the whole truth on both sides. Inaccurate general statements defeat their own objects, and give impressions which cause the uninformed reader to take a position

one good material will not aid in securing recognition of another good material, even if it is a far better one.

The fifth chapter gives results of various kinds of tests of concrete and vitrified to soft-burned grades of clay tile and pipe made in Iowa, Brooklyn, Colorado, Germany, Arizona and California.

The sixth and seventh chapters give reports of the experience of various makers of cement tile in making pipe, some of them giving details of amount and character of materials and labor and cost of the same. They are illustrated with photographs and ground plans of large and small plants in operation, and give the fullest story of the industry that has been published. The last chapter gives descriptions of the machines and processes on the market. These descriptions are very brief. The reader who is looking for help in finding the plant or process he needs to fit his conditions would be thankful for fuller and practical directions for the operation of all the machines. Specifications for the kinds of pipe which can be made by the various processes and on the machines would also be of practical benefit.

Principles of Sewage Treatment, by Professor Dr. Dunbar, director of the Hamburg State Hygienic Institute. Translated by H. T. Calvert. Cloth, 271 pp., 147 illustrations, $4.50. J. B. Lippincott Company, Philadelphia, Pa.

Dr. Dunbar speaks with authority and has covered the theory of sewage purification thoroughly, with many indications of the practical methods and of the successes and failures in their application. The first part of the book is historical, showing the increase in river pollution which led to legal measures for abatement, with examples from English, French and German conditions. The rise and development of method of sewage treatment is sketched, and the earlier views of the object and utility of these methods are quoted.

The second part states the present position of sewage treatment. The characteristics of sewage are shown, and the objects of purification works. The details of the various classes of methods are given in chapters on removal of suspended matters in detritus tanks, by sieves, gratings and screens, by grease extractors, in settlement, septic and precipitation tanks; on removal of putrescibility by surface irrigation, land filtration and artificial biological methods, contact beds and percolating filters; and the disinfection of sewage. There are also short chapters on the supervision and inspection of sewage disposal works and on the comparative utility and cost of the various methods of sewage treatment.

The author is prominent in Germany for his experiments particularly upon contact beds and filters, as well as upon methods of disinfecting sewage, and the book is particularly full upon these subjects. Indeed, the writer is not familiar with any more thorough treatment of the theory of these processes than is here presented. While the examples used are practically all taken from German and English sources, the conditions and methods are so carefully considered and so logically put together that the reader is ready to apply them to new conditions of similar nature with confidence as to the directions to proceed and to avoid. This is the strong point of the book. Dimensions of details must be sought elsewhere. And because of the careful restriction of the discussion to the selected lines, the book is very readable, and takes a place as perhaps the most complete theoretical discussion of the principles of sewage treatment which is possible at the present stage of advancement in the art.

General Specifications for Concrete Bridges. By Wilbur J. Watson, Consulting Engineer. 82 pp. Paper, 50 cents. M. A. Vinson, Caxton Building, Cleveland, O.

The author divides concrete bridges into ten classes, according to weight and character of traffic, ranging from heavy railroad bridges to foot bridges. He divides them according to design into four types, beam, truss, culvert or short arch, and arch bridges of 40 feet span or more. Weights for use in designing each class of bridges are assumed, and definite definitions of all terms are given, also statements of allowable unit stresses, so that there can be no ambiguity in these important matters.

The specifications are then given under the headings of quality of materials; proportioning, mixing and placing; inspection and tests; concrete slab, beam, girder and column construction; reinforced concrete trusses; reinforced steel construction; reinforced concrete unit construction; cast stone and blocks; concrete arches; retaining and sea walls; concrete abutments; concrete piers; concrete footings; concrete piles; forms and centers; surface finish; waterproofing; pavements and foot walks; freezing weather; contractor's plans; general conditions and contract clauses. Appendices give the standard specifications for cement of the American Society for Testing Materials, an analysis of reinforced concrete beams, tables of properties of various forms of bar, brief pavement specifications, diagrams and tables of standard bridge loadings, coefficients of impact, working unit stresses for timber, earth pressures and a list of data required for designing concrete bridges.

The set makes an excellent form to follow in making up specifications for a particular structure, although they will need, of course, more or less modification to meet the local requirements and more detail in various respects, depending upon the character and quality of the work to be done.

Sanitation of Public Buildings. By William Paul Gerhard, C. E. 273 pp. Cloth, $1.50, net. John Wiley & Sons, New York.

The buildings considered in this book are the hospital, theater, church, school, market and abattoir. The author seems to have had most experience with the design of the sanitary features of hospitals, as the detail is more thoroughly treated and with greater assumption of authority. He has also made a close study of theaters and of churches and schools, while his work with markets and abattoirs seems to be more in the nature of observation. This opinion is based on the treatment of the subjects wholly, and its expression shows the impression which the book makes upon the reader.

The author's ideas of the necessity of strict attention to sanitary principles are worthy of careful attention, and where he goes into detail he can be followed safely. When he describes general conditions and makes general statements of methods he is sometimes a little behind the times, and while the appendices and some of the quotations in the later chapters of the book are from the latest literature and the latest governmental and municipal codes, the text itself bears some marks of preparation some years ago. As already stated, this does not apply to the earlier chapters, particularly that on hospitals, although even here he does not report the very latest improvements in sewage disposal or sewage collection.

The book is well worth its price as a reminder of the points which must be covered in a design and of the publications in which details may be studied. Even here the proportion of books and articles bearing dates later than 1898 is small, considering the material advances that have been made in mechanical ventilation, sewage disposal, plumbing appliances, etc., during the last ten years.

Land Treatment of Sewage; a digest of the reports made to the Royal Commission on Sewage Disposal by their specially appointed officers. By Herbert T. Scoble. Cloth, 176 quarto pages, $2, net. St. Bride's Press, London, and D. Van Nostrand Company, New York.

As the sub-title indicates, this is a very convenient summary and collection in a single small volume of the official reports upon the plants in use in England for land treatment of sewage and the conclusions regarding their success. The book includes descriptions of the plants at Aldershot Camp, Altrincham, Cambridge, Croydon, Leicester, Nottingham, Rugby and South Norwood, and also gives some data regarding several other farms which have been visited by the author.

The effect of soil conditions, rates of filtrations and other variables are compared, and the author adds his conclusions to those of the government examiners. The book will be very valuable for those who are considering the question of land treatment of sewage, largely in determining what not to do, although some of the plants described are reported to be very successful.

The Design of Steel Mill Buildings and the Calculation of Stresses in Framed Structures. By Milo S. Ketchum, C. E. Second Edition, Enlarged. 480 pp., cloth, $4, net. Engineering News Publishing Co., New York City.

A second edition of a book of this sort in scarcely more than two years is evidence of the value of the book and the need for it. More than a hundred pages of new material have been added, although the first edition seemed to be quite complete.

Being the result of some years of practical experience, and of a considerable period of experience in teaching, the book meets the needs of both students and practical engineers in a rather unusual manner.

The first part discusses loads, dead, snow, wind and special. The second part discusses stresses, giving the principle of graphical statics, and methods of computing stresses in framed structures and beams. Chapters on stresses in a transverse bent and in portals are particularly practical and give the student excellent guidance through a subject which they are apt to believe abstruse. Two-hinged and three-hinged arches, combined and eccentric stresses are the subjects of other chapters and complete a very usable discussion of the theoretical side of the subject.

The third part discusses the design of mill buildings under the chapter heads, general design, framework, corrugated steel, roof coverings, side walks and masonry walls, foundations, floors, windows and skylights, ventilators, doors, shop drawings and rules, paints and painting, estimate of weight and cost. In each of these chapters many minute details are given in full and there are many examples from existing roofs showing the application of these details.

The fourth part gives quite full descriptions of a number of interesting structures, among them the largest steel frame dome, that on the West Baden hotel, the St. Louis coliseum, several locomotive shops, government buildings, a reinforced concrete roundhouse.

The appendices give full specifications for a steel building, solutions of a number of problems in graphic statics and the calculation of stresses, and tables of dimensions of many structural details.

The book fully deserves its success and the new edition is brought up to date.

ORGANIZATIONS AND INDIVIDUALS

American Society of Municipal Improvements—Chicago Cement Show—Technical Meetings—Civil Service—Engineering Schools—Personal Notes.

Little Rock's Share of the Program of the American Society of Municipal Improvements.

With a general committee of 29 members, E. A. Kingsley, chairman; a program committee of 6 members, E. A. Kingsley, chairman; a reception and luncheon committee of 3 members, R. C. Powers, chairman; a committee on tour of local industries of 5 members, Fred I. Brown, chairman; a hotel committee of 11 members, E. C. Taylor, chairman, and a ladies' executive committtee of 5 members, Mrs. E. A. Kingsley, chairman, Little Rock shows its intention to give the members of the American Society of Municipal Improvements and their friends and families a thoroughly satisfactory experience with Southern hospitality and to give them as full and favorable a view of Southern conditions and prospects as can be obtained in the four days at their disposal.

Tuesday, Nov. 9, will be devoted to three business sessions of the convention, and there will be one full business session on each day, Wednesday and Thursday.

Wednesday morning the railroads give a trip to the industrial plants of the city, starting from the foot of Broadway at 9 a. m. The Baring Cross shops of the St. Louis, Iron Mountain & Southern railroad, the Arkansas and Dixie cotton seed oil mills, the St. Louis cotton compress plant, the Ayer-Lord creosoting works, the Arkansas Brick Company's plant and the power plant of the Little Rock Railway and Electric Company will be visited, luncheon being served at the last point. Wednesday evening wil be devoted to a reception and luncheon.

Thursday morning will be filled by a street-car ride viewing street and other public improvements from special cars. In the evening there will be informal receptions at the clubs, hotels and private residences.

On Friday the association will visit Memphis, Tenn., on invitation of the mayor and legislative council and the Business Men's Club, and an unusual opportunity will be given to see this, which is considered by many to be the coming city of the South, as it is now the greatest in the central south.

Little Rock has two hotels which are new and large and fully up to date, which the traveling men, who know, say are equal to any in St. Louis, but practically everything but a sleeping place has been provided by the local committees.

Arrangements should be made for the trip by all city officials in charge of municipal improvement work of any kind, for the program of papers and discussions will be fully equal in its field to the attractions offered by the local committee, and the combination is too valuable to be missed. Probably homeseekers' rates, about half-fare, can be secured on the first Tuesday in November if no other special rates offer.

The local committee has prepared a special illustrated circular about the city and the convention, copies of which wil be sent for distribution by E. A. Kingsley, Superintendent of Public Works, Little Rock, Ark.

Third Annual Cement Show.

The demand for spaces at the third annual cement show in the Coliseum, Chicago, February 18-26, 1910, is very brisk according to reports from the offices of the Cement Products Exhibition Co., 115 Adams street, Chicago. The general floor arrangement at the next show will be somewhat similar to that of the show last February. The scheme of furnishing uniform equipment and decoration for all exhibitors will again be followed. The main feature of the decorative scheme at the next show will be a large ornamental centerpiece, thirty feet in diameter and placed in the center of the Coliseum floor. A competition is being held by the Cement Products Exhibition Co., for a design for this centerpiece. It is to be constructed of concrete and may take any form the artist may suggest; some are designing pergolas, others fountains, band stands, etc. Three hundred and fifty dollars in prizes are being offered for the best designs for a centerpiece. There will be a number of new features in connection with the next cement show. The space rates have been only slightly increased over those which prevailed last year, the purpose being to provide some funds for advertising the coming show.

The National Association of Cement Users, the American Society of Engineering Contractors and the Illinois Association of Municipal Contractors will all

hold their conventions in Chicago during the show. It is expected that the annual meeting of the National Builders' Supply Association will also be held here. All these conventions together with the elaborate preparations for the show will mean a tremendous gathering of building material interests in Chicago next February. The National Association of Cement Users expects the best program of addresses that has ever been presented. President Jackson and Secretary Hauer of the Engineering Contractors' Society will also have an excellent program for the members of this big organization. Cement and concrete construction will probably play the most important part in the discussions of this society.

Technical Meetings.

The annual convention of the American Street and Interurban Railway Association will be held in Denver, Colo., October 4, 5, 6, 7 and 8. Bernard V. Swenson, sec'y, 29 W. 39th st., New York City.

The annual convention of the American Public Health Association will be held at Richmond, Va., October 19, 20, 21 and 22. Charles O. Probst., sec'y, Columbus, O.

The annual meeting of the American Gas Institute will be held at Detroit, Mich., October 20. A. B. Beadle, sec'y, 29 W. 39th st., New York City.

The fourteenth annual convention of the International Association of Municipal Electricians was held at Atlantic City, N. J., September 14, 15 and 16. Papers were submitted as follows: "The Construction of Underground Conduits;" "Grounds of Alternate Current Secondaries;" "National Electric Code and Its Proper Interpretation;" "Locating Faults in Fire and Police Telegraph Circuits Without Opening the Lines;" "Progress of the Fire Alarm Telegraph;" "The Storage Battery for Fire and Police Telegraph Systems."

The thirtieth annual convention of the Association of Edison Illuminating Companies was held at Briarcliff Lodge, Briarcliff Manor, N. Y., Aug. 30, 31, September 1 and 2. Among some of the papers submitted were the following: "Special Illumination Features of the Hudson-Fulton Celebration;" "The Tungsten Lamp Situation in Various Cities;" "Prepayment Meters;" "The Central Station and the Electric Vehicle." Thomas E. Murray, M. Am. Inst. E. E., was elected president of the association for the coming year.

The National Good Roads Congress will hold its convention at Columbus, O., October 26, 27, 28 and 29.

The annual convention of the New England Water-Works Association was held in New York City, September 8, 9, and 10. The convention opened with an address of welcome by George S. Rice, chairman of the committee of arrangements, and other preliminary business, and with an address on the New York water supply by William W. Brush, engineer of distribution of the waterworks of New York City. This address was illustrated by lantern slides, and outlined the water supply system of Greater New York. James L. Tighe, city engineer of Holyoke, Mass., presented a paper on 'Odors and Tastes in the Water Supply of Holyoke." He reviewed that city's experience with tastes and odors in stored surface water, from the early '70's to date, giving some curious and interesting extracts from early reports and newspaper articles dealing with the taste and odor nuisance. The suggestion made for alleviation varied from windmils and flotilla of boats for agitating the water and thus aerating it, to the application of modern scientific methods for the study of the causes of tastes and odors in public water supplies. "Water Purification at Poughkeepsie, N. Y.," was the subject of a paper submitted by Dr. John C. Otis, president of the board of public works of Poughkeepsie. H. W. Clark, chemist Massachusetts State Board of Health, Boston, Mass., presented a paper on "Disinfection as an Adjunct to Water Purification." Brief reports of the conservation committee and the committee on damages resulting from the diversion of water were made by M. N. Baker and Leonard Metcalf.

The proceedings of the convention of the Indiana Sanitary and Water Supply Association held in Indianapolis in January, 1909, have just been issued by the secretary, Frank C. Jordan, secretary of the water company, Indianapolis, Ind.

L'Edilite Technique is a monthly periodical, published in French, which is the official organ of the Union of Technical Municipal Service and Public Works and is sent free to members of that organization but is delivered to others at 20 francs a year.

The proceedings of the last convention of the Indiana Engineering Society have just been issued by the secretary, Chas. Brossmann, Union Trust Bldg., Indianapolis, Ind.

The *Michigan Technic* is issued by the Engineering Society of the University of Michigan in semi-annual numbers in February and June.

At the meeting of the Municipal Engineers of the City of New York, held Sept. 22, J. C. Meem presented a paper entitled "Construction Problems of the Brooklyn Subway."

The National Municipal Legaue has settled as the topic for next year's competition for the $100 Wm. H. Baldwin prize "City Government by Commission," and suggests as an outline of the method of

treatment a brief statement of conditions leading up to the adoption of the system, a study of the Galveston plan and of the various modifications by other cities, and an analysis of the working of the system, the difficulties encountered and the safeguards and remedies adopted and suggested. The competition is open to undergraduates in colleges offering distinct instruction in municipal government.

The Northwestern Cement Products Association will hold its next convention in St. Paul, Minn., March 1 to 5, 1910. Martin T. Roche, of Minneapolis, Minn., is president.

The American Peat Society held its third annual meeting at the Massachusetts Institute of Technology, Boston, Mass., Sept. 23 to 25.

The Cornell Society of Civil Engineers of New York now has a membership of 323. It holds three or four meetings a year and is gradually forming a place for itself in the society world. H. G. Balcom, 314 Madison Ave., New York, is secretary.

The American Civic Association and the National Municipal League will meet in joint session in Cincinnati, Nov. 15 to 18. This follows the A. S. M. I. convention at Little Rock, and those from the East attending that convention would find it easy and certainly very profitable to stop over for the Cincinnati convention.

The Permanent International Association of Road Congresses has been formed to promote the international congresses, the first of which was held in Paris last year. The second International Congress of the Road will be held in Brussels in 1910, beginning July 31.

The ninth annual conference of health officers in New York State will be held in Rochester Nov. 10, 11 and 12. A number of experts will be present to address the convention.

Among the many publications pertaining to the New York Hudson-Fulton celebration is a beautiful illustrated monograph on "The Indians of Manhattan Island and Vicinity," by Alanson Skinner, of the department of anthropology in the American Museum of Natural History.

Civil Service Examinations.

The U. S. Civil Service Commission will hold examinations in the usual places as follows:

Oct. 20-21: Highway engineer and senior highway engineer in Office of Public Roads, Department of Agriculture, at $1,200 to $2,250 a year; also draftsman in Patent Office, Washington, D. C., at $1,000 a year.

Oct. 27: Teacher of mechanical drawing in Indian service at $600 to $840 a year.

Engineering Schools.

The latest University of Illinois Bulletin has a report on "The Mineral Content of Illinois Waters," by members and employes of the State Water Survey of which Edward Bartow is the dirctor.

Personal Notes.

B. B. Reynolds has been appointed Water superintendent at Colorado Springs, Colo.

Hon. John J. S. McCroskery, ex-mayor of Newburgh, N. Y., died September 18, aged 75 years.

Charles F. Wingate, sanitary engineer, New York City, died at his home August 31, aged 62 years.

W. H. Gass has been elected water commissioner at Knoxville, Tenn. Mr. Gass was formerly mayor of that city.

Gilmour Brown, of St. John, New Brunswick, has been appointed chief engineer of the department of public works at Ottawa, Ont.

Joseph E. Beals, water commissioner for 25 years at Middleboro, Mass., and a member of the New England Water Works Association, died September 3.

J. H. Phillips, M. Am. Soc. C. E., has been appointed principal assistant to the engineer and superintendent of the Esses County Park Commission, Branch Brook Park, Newark, N. J.

John R. McWane, who is a grandson of the founder of the Lynchburg Foundry Co., has been appointed western sales manager and has opened headquarters in the Monadnock building, Chicago, Ill., for the sale of their water and gas pipe and special castings.

Philip Burgess, Assoc. M. Am. Soc. C. E., A. E. Kimberly and Charles F. Long have severed their connection with the Ohio State Board of Health and have established offices in the Columbus Savings & Trust Building, Columbus, Ohio, for the practice of consulting sanitary and chemical engineering under the firm name of Burgess, Kimberly & Long.

Frank Miller and E. McLean Long have formed a partnership and will design, inspect and superintend all kinds of steel and masonry construction, foundations, mechanical equipment of buildings, land derricks and floating derricks. They are established at 220 Broadway, New York City. Mr. Miller has, for the last six years, been chief engineer of the Snare & Triest Co., and Mr. Long has practiced as civil and consulting engineer.

In behalf of the New England Water-Works Association, Mr. F. D. Dean, of Boston, Mass., is investigating matters relating to the purchase by municipalities of privately owned water-works. To further this investigation Dr. Dean has prepared a very complete data sheet, which includes all items relating to the source of supply, the water systems, including stations, piping, etc., the water consumption, and the financial end such as cost of operation, taxes, income, securities, debt, etc. This data sheet may be obtained by writing to Mr. Dean at 53 State street.

New York Appropriation for Tests of Concrete.

An appropriation of $30,000 was asked for by Nelson P. Lewis, chief engineer of the board of estimates and apportionment of New York City, September 17, to defray the cost of conducting experiments ordered by Mayor McClellan to determine the relative merits of reinforced cinder, gravel, slag, and stone concrete, and hollow terra cotta tile. Architects, builders and contractors in all parts of the country will be interested in these tests.

MACHINERY AND TRADE

Specifications for Making Macadam Road with Liquid Asphalt Binder.

The necessity of vastly improving the surfaces of macadam roads to meet the demands of automobile traffic has given rise to a large number of preparations of tar and asphalt to be used in the treatment of old roads and the construction of new, and many manufacturers now supply the materials. Each kind of material requires some attention to its particular characteristics in the specifications for the road, and MUNICIPAL ENGINEERING has printed quite a number of these specifications. The following are those prepared for incorporating heavy liquid asphalt in the construction of stone roads, by the Indian Refining Company:

(1) Roadbed Sub-Foundations. — The roadbed shall be excavated or filled to the subgrade as established by the grade stakes of the civil engineer, and shall be thoroughly rolled with a steam road roller of the three-wheel type, having at least 400 pounds compression per lineal inch on rear rolls, the rolling to be continued until the roadbed is thoroughly consolidated to the satisfaction of the engineer in charge of the work; all soft or spongy places shall be removed and refilled with gravel or other material that willl pack and be rerolled until the subgrade is solid and to the desired grade. The roadbed, to the widths and depths as shown in plans, must be excavated or built to the same curvature or crown as that of the surface of the finished road, the cross-section thereof conforming in every respect to the cross-section of the road when finished. All excavations shall be completed for the full width of the road from gutter to gutter before any stone is applied on the road.

(2) Shouldering.—A shoulder of firm earth or gravel is to be left or made on each side, extending at the same grade and curvature of road to side ditches or gutters. This shoulder is to be rolled according to the directions of the engineer.

(3) Side Ditches or Gutters.—The side ditches or gutters are to be excavated as per stakes furnished by the engineer, in order to give an easy flow of water, so that no water shall be left standing on the road or in the ditches. Under-drainage must be resorted to when the subgrade contains water or is soft and spongy.

(4) First Course of Broken Stone.—Upon the prepared roadbed shall be spread a layer of stone, broken to pass through a ring 3 inches in diameter, to the uniform depth of four (4) inches, which shall be rolled until solid and firmly locked together.

(5) The depth of loose stone in this and all other courses must be measured by blocks the required thickness of the said loose stone. These blocks must be placed at frequent intervals amid the loose stone when being spread.

(6) Binder Between the First and Second Courses.—Upon the bottom course of stone shall be spread a binder course consisting of stone screenings, clean gravel or a mixture of one-half screenings and clay, to the depth of two (2) inches, and rolled until it will not give under the weight of the roller. If the material used for binder is of such nature or in such condition that an application of water will add to its value as a binder, the same may be ordered by the engineer in charge.

(7) Second Course of Stone.—When the binder course is applied and rolled as above described, a second course of stone, broken to pass through a ring 1½ inches in diameter, shall be spread evenly over the surface to a uniform depth of four (4) inches and rolled until compact; then a layer of stone screenings, clean gravel or sharp sand, of sufficient quantity, which when rolled dry will fill practically 50 per cent. of the voids in this course of stone, shall be applied and rolled until shaken down, leaving the 1½-inch stone exposed on the surface.

(8) Liquid Asphalt.—Upon the surface thus prepared, the liquid asphalt shall be applied hot and distributed evenly over the surface by means of a mechanical distributor, which will spread the liquid asphalt evenly and be so arranged as to control the quantity delivered. The distributor valve not to exceed 6 ft. 3 in. in length, divided in sections not more than 2 ft. 1 in. in length and under full control of the operator in order that the liquid asphalt may be applied on the surface either two or four feet wide, or the total width of the distributor, as desired. The quantity of liquid asphalt to be used to be 1.3 gallons per square yard where trap rock is used, and 1.5 gallons per square yard where limestone is used in the construction of the road proper.

(9) Surface Binder.—After the application of the liquid asphalt, allowing from five to ten hours for it to penetrate the top course of stone, a coat of 50 per cent. dust screenings and 50 per cent. of ½-inch stone, properly mixed, of sufficient thickness to fill the voids and make a smooth and uniform surface, shall be spread, when

the road shall again be rolled until thoroughly consolidated and the liquid asphalt is brought through to the surface. Should the liquid asphalt show a tendency at this point to stick to the wheels of the roller, a light sprinkling of water on, or immediately ahead of the roller, can be used until the surface is rolled to a compact mass.

(10) Finished Road.—The road to be finished by sweeping or spreading a light coat of screenings over the surface to take up any excess of liquid asphalt which may be brought to the surface by rolling.

Notes.—As a matter of economy in the application of the liquid asphalt, if possible, it is advisable to prepare a sufficient area of the surface of the road to use the contents of one car before the application is begun, thereby saving demurrage on the tank cars and also part of the expense of heating the liquid asphalt.

The improvement should be started at the end of the road farthest from the source of supply of broken stone.

Either trap rock, hard limestone, or other stone equally as good, shall be used in the construction of the road.

No clay shall be used as binder in the top layer of 1½-inch stone or the finished surface. It is tolerated in the composition of the binder between the first and second courses only as a matter of economy.

Heavy liquid asphalt binder (12-14 gravity, asphalt contents 82 per cent.) shall be used, manufactured by the Indian Refining Company, offices Cincinnati, Ohio, and 115 Broadway, New York City.

Heavy liquid asphalt binder is shipped in tank cars only, capacity 8,400 or 10,400 gallons. Said cars are equipped with steam pipes for the purpose of heating the liquid asphalt. Where a supply of steam from a stationary plant is not available, the additional equipment required consists of a portable boiler of from 10 to 20 h. p. and the necessary steam hose to make connection between the boiler and tank car. The liquid asphalt shall be heated to a temperature of from 180 to 200 degrees Fahrenheit, and pumped into a tank wagon equipped with a distributor, and with this wagon the liquid asphalt is hauled and spread upon the road.

Municipal Ice Plant Not Legal.

In an opinion rendered by Edward Kenny, August 26, counsel for Kearny, N. J., he held that that municipality has no legal right to establish a municipal ice plant. He cited that while the citizens may vote on appropriations for municipal improvements, such a proposition as the building of a town ice plant is not included under that heading, and if the citizens should take advantage of the referendum and vote for an appropriation to construct an ice plant for the town, the courts would undoubtedly declare the proceeding unconstitutional.

Bronx Borough President Removed.

Governor Hughes, of New York, ordered the removal of Louis F. Haffen, president of the borough of Bronx in the city of New York, recently, charging him with misconduct in office and neglect of duty. Governor Hughes found that public funds in President Haffen's department were wasted by loading the pay rolls; that there was political jobbery in the building of the Bronx Borough court house; that he was interested in the improvement of a public highway, with a view to benefiting himself and his associates, who had holdings in a land company, and that as borough president and chairman of the local board of Morrisania he recommended the acquisition by the city of certain property on the East river for use as a public bathing place which was utterly unsuitable for the purpose.

How to Use Cement.

The Atlas Portland Cement Co., 30 Broad St., New York, N. Y., issue a revised edition of "Concrete Construction About the Home and On the Farm," (for free distribution), which has become a recognized text book of cement users. It is fully detailed and illustrated and thoroughly reliable.

They also publish a book on "Concrete in Highway Construction" ($1), primarily for the road supervisor, engineer and contractor, which contains much valuable detailed practical information on concrete making and laying, sidewalks, curbs and gutters, concrete street pavements of varings and conduits, culverts, beam bridges, arch bridges, retaining walls, posts, fountains, etc.

There is also a book on "Concrete in Railroad Construction" ($1) with details of construction of bridges, culverts, retaining walls, stations, train sheds and platforms, coal and sand stations and ash-handling plants, signal towers, water tank supports and bumping posts, power stations, storage reservoirs, docks, tunnels and tunnel lining, concrete ties and roadbeds, telegraph poles, power transmission poles and towers, posts and fences, furnished by engineers on the roads named.

The two latter books are so special in their nature that the price named has been put on them. The first named will be sent on request.

Durable Street Curbing.

tI has been called to our attention that the street in Niagara Falls, N. Y., shown in one of the photographs on p. 171 of the September number of MUNICIPAL ENGINEERING, has Berea sandstone curb and has been in service for 5 years. This gives an opportunity to point to the fact that sandstone curb from the Berea, O., quarries of the Cleveland Stone Co., have been

in use in many cites of Ohio, New York, Illinois, Indiana, Iowa, Michigan and other states in many cities for periods of twenty, twenty-four and more years. The Cleveland Stone Co., Cleveland, O., will send a booklet showing photographs of many such streets, as well as cuts showing the quarries, the machines for dressing stone and the styles of finish of surfaces.

Testing Asphalt.

Harry Tipper, of the Texas Company, New York, has written a series of articles on testing asphalt, which have been collected in a booklet for the convenience of those interested in the subject. The tests discussed are those for ductility, penetration, melting point, flow point and the chemical tests with carbon bisulphide, carbon tetrachloride and naptha. Illustrations of the various pieces of apparatus in use are shown and the booklet is quite a mine of information on methods and results. Doubtless copies will be sent on request from interested persons.

The Polygon Concrete Mixer.

The polygon concrete mixer, made by the Waterloo Cement Machinery Corporation, of Waterloo, Iowa, is a revolving mixer, doing much of its work on account of the contour of the drum, aided by way of acceleration of action by four to six blades. It is a tilting mixer, discharging and being charged quickly and certainly. It is a batch mixer, the manufacturers agreeing with many engineers and contractors, including those on government work, that this is the proper method to insure perfect mixing and uniformity in proportions. It is said that on account of the perfection in mixing a saving of 20 per cent. in the cement used is possible.

The drum is built of two truncated cones on the ends of a short cylindrical drum, the combination being set with its axis at an angle of 45 degrees with the main axis of motion of the mixer. The inlet and outlet are in the surfaces of the opposite cones, on a horizontal line when the drum is in the usual mixing position. The form, with the blades mentioned, produce rapid results, ten revolutions in less than 30 seconds giving a uniform tint throughout in the red oxide of iron test.

The mixer may be purchased without power or with steam, gasoline or electric power as desired. The drive is a direct bevel gear.

The company have issued a new, handsomely illustrated catalog, showing in detail all the forms and sizes of the mixer, the engines and special appliances, such as side loader, measuring tank, concrete elevator, carts and spreaders, wheel barrows, stone crushers, sand screens, scoop and side dump cars and light railway equipment.

This is one of the most satisfactory catalogs we have had the pleasure of examining. It will be sent by the company on request from those interested.

Trade Publications.

The Universal Portland Cement Co. of Chicago and Pittsburg publish *The Farm Cement News*, devoted to the uses of cement on the farm. One of their recent publications is a reprint of J. H. Chubb's paper on "Cost and Value of Concrete Pavements," which he read at the last convention of the National Association of Cement Users.

The Vulcanite Portland Cement Co. announces on its circular an annual output of 1,750,000 barrels of cement, the result of 14 years of successful manufacture of the highest grade of Portland cement.

The Northampton Portland Cement Co. issues a highly illustrated booklet giving an article on "Proper Economical Proportions for Concrete," by J. A. Setze, a list of important works in which their cement has been used and photographs of a number of the structures. This true Portland cement has been on the market 10 years.

The Lock-Joint Pipe Co. print an article describing and illustrating the construction of two large suction pipes for the Public Service Corporation of New Jersey at Marion, N. J., made of reinforced concrete according to their system. The process and product are very interesting and well worth the trouble of writing to the company, at 165 Broadway, New York, for a copy of the article.

The Marquette Cement Manufacturing Co., Marquette Bldg., Chicago, Ill., has a little circular on "Choosing the Right Brand," which gives some valuable pointers.

Bulletin 64 of the Universal Portland Cement Co., in addition to the usual illustrations and descriptions of curb in which Universal cement has been used, gives some instructions about management of shipments and notices of the same and an illustrated article on the local advertising of cement.

The Ashland Steel Range and Mfg. Co., Ashland, O., have an illustrated circular fully illustrating their cement block machine and structures built with it, the various forms of block and faces and their eminently successful concrete mixer for the small and medium operator. It is an automatic measuring machine operated by a gas engine enclosed to protect it from the dust.

We have received a detailed price list of the blue print papers helios, E. T., parchmine and Columbia and Columbia blue print cloth, which are manufactured by Keuffel & Esser Co., Hoboken, N. J., 111 E. Madison St., Chicago, Ill., and 127 Fulton St., New York, and have been in use on the market for years.

Eugene Dietzgen & Co., 181 Monroe St., Chicago, Ill., send sample of Wenonah drawing paper, of print made on Dietzgen lumine paper and circular describing a

number of special drawing, calculating and other instruments.

Modern methods of road construction and preservation are quite fully described in an illustrated article, copies of which will be sent by the Barrett Mfg. Co. from any of their numerous offices.

A recent circular from the Indianapolis office of the Lehigh Portland Cement Co. gives some pictures of buildings in which Lehigh cement has been used "From the Architect's View Point." The annual capacity of the several plants of the company is now 11,000,000 barrels a year.

The International Sand-Lime Brick and Machinery Co., 90 West St., New York, N. Y., send various circulars descriptive of their silicate brick and its uses and the machinery and methods for making the bricks in large quantities.

A booklet of the Barrett Mfg. Co. illustrates a large number of railroad roundhouses and shops on which Barrett specification roofs have been used and have stood the severe test of this location with satisfaction.

An artistic product of the printers' art is the book of the Lawrence Portland Cement Co., on Dragon Portland cement. It gives a chonological table of the history of Portland cement, the standard specifications, instructions about sand for mortar, finishing concrete surfaces, water-proofing, rust in reinforcement, etc., as well as specifications for many kinds of concrete work and illustrated descriptions of many structures in which Dragon cement has been used. The book will be sent on request. This cement has been in use for over twenty years.

Trade Notes.

ASPHALT.

St. Louis, Mo.—Street Commissioner Travilla recommends, in his annual report submitted September 10, the erection of an asphalt plant to enable the city to do its own asphalt repairing.

BRICK.

Buffalo Gap, Va.—The erection of a plant for the manufacture of paving brick is proposed by the Elliotts Knob Coal & Iron Company.

Roanoke, Va.—C. Markley and the Exchange Lumber Co., of this city, have leased the plant of the Webster Paving Brick Co., and will manufacture high-grade paving block. Mr. Markley will have charge of the new enterprise.

CEMENT.

Fort Scott, Kas.—Involuntary bankruptcy proceedings were filed here September 14 by the bondholders of the Chanute Cement & Clay Products Co., and C. B. White, of Fort Scott, was appointed receiver. The petition places the assets of the company at $250,000 and the liabilities at $2,000,000, and alleges irregularity in the execution and filing of mortgage bonds as a means of preferring certain creditors. The company operates branches at Bronson, Michigan, and Akron, Ohio.

CONCRETE BLOCKS.

Camden, N. J.—The American Concrete Piling Co. has been incorporated by Louis E. Welsh, Frank Overn and Elmer S. Holmes.

PURCHASE OF MACHINERY.

McKinney, Tex.—(Special).—C. W. Noyes, Box 337, is in the market for machinery and tools for manufacturing blocks, posts and other forms of concrete articles.

Ely, Neb.—(Special).—W. E. Meyers advises us that he desires to purchase concrete block machines.

Coffeyville, Kas. — (Special). — James Harbaugh, 709 W. 5th st., advises us that he is in the market for a concrete mixer.

Clay Center, Kas.—Special).—Henry M. Roth advises us that he is in the market for a concrete mixing machine, and desires catalogues and prices by return mail.

Pearl Harbor, Hawaii.—Bils are asked until Oct. 5 for furnishing one machine for making concrete building blocks. Bureau yds. and docks, Washington, D. C.

LIGHT, HEAT AND POWER.

Butler, N. J.—The Butler Electric Light & Power Co. has been incorporated by Evan C. Jones, John B. Lydecker, and Henry R. Schneider.

Elyria, O.—The Elyria Gas Power Co. has been incorporated by C. O. Hamilton, J. D. Kiser, C. M. Blanchard, J. A. Gahagan and F. M. Sterns.

MISCELLANEOUS.

Minneapolis, Minn.—Owing to the fact that the estimate roll for 1910 did not include the proposed municipal creosoting plant, the purchase of one may be deferred a year.

Cincinnati, O.—The contract for furnishing oil for the Reading pike was awarded, Sept. 10, to the Indian Refining Company, by the county commissioners, at $0.0275 per sq. yd., or a total of about $2,418. The Standard Oil Co. bid $0.0285.

Cincinnati, O.—The Compressed Wood Preserving Co. has been organized and incorporated by business men of this city for the purpose of manufacturing wood blocks for paving and railway ties. The incorporators are George C. Schneider, Henry Vogel, H. W. Weisbrodt, Martin Rosenberger, Charles E. Roth and Albert Bettinger.

Patents Concerning Street and Road Construction and Repair.

853,117. Bituminous Composition. Clifford Richardson, New York, and Charles N. Forrest, Brooklyn, N. Y.

853,720. Oil Spreader. Wm. M. Murray, Sawtelle, Cal.

854,894. Grading Machine for Building and Repaving Roads. Walter A. Jones, Coolidge, Ga.

855,860. Manufacturing Means from Wood Tar for Preventing Dust on Streets, Roads and the Like. Stephens Mattar, Leipsig, and Robert Funcke, Lorch, Germany.

856,105. Pavement and Method of Making the Same. Wm. J. Sinek and Rudolph S. Blome, Chicago, Ill.

856,928. Roadway for Vehicles. Z. T. Sweeney, Columbus, Ind.

858,685. Elevating Road-Grading Machine. Albert E. Van Duser and J. O. E. Krohn, Chicago, Ill.

849,079. Road Grader. Joseph McMahill, Walnut Grove, Ill.
853,131. Paving Machinery. Frank B. Smith, Philadelphia, Pa.
860,674. Plastic Pavement Plant. Geo. W. Lamson, Chicago, Ill.
861,576. Road Scraper and Leveler. Robert A. Dinsmore, New Athens, O.
861,650, 861,651. Artificial Structure and Process of Making Same. Walter E. Hassam, Worcester, Mass.
862,012. Construction of Brick Pavements. Joseph M. Perkins, Memphis, Tenn.
862,318. Paving Material and Manufacture Thereof. Jesse A. Dubbs, Pittsburg, Pa.
862,939. Process of Mixing with or Dissolving in Water and Distributing Material to Be Applied to Streets, Roads or Railroads. Benj. P. Richardson, Brookline, Mass.
863,096. Pavement (wood). Herman J. Rufli, Mobile, Ala.
864,497. Road Scarifier. Edward T. Wright and Charles Longenecker, New York, N. Y.
864,498. Road Roller, Edward T. Wright and Charles Longenecker, New York, N. Y.
864,839. Asphalt Block Press. John C. Fowler, Sewaren, N. J.
865,578. Composition for Laying Road Dust. Carleton Ellis, Larchmont, N. Y.
869,181. Constructing or Paving Street. Road and Other Ways. John D. Henderson, Everett, Mass.
870,775. Roadway for Automobiles. Leslie S. Hackney, St. Paul, Minn.
870,889. Paving Block (next to street car rail). Alexander Kelley, Wilmington, Del.
872,159. Combined Scalper, Excavator, Roadroller and Locomotive. Chas. J. Van Buren, Findlay, O.
873,975. Road Roller. Edward T. Wright and Charles Longenecker, New York, N. Y.
874,716. Road Roller. Edwin C. Sherwin, Brandon, Wis.
876,377. Roadway. Geo. A. Arthur, J. and Ernest E. Mitchell, London, Eng.
876,846. Road Machine. Stephen W. Smith, Douglasville, Ga.
878,638. Asphalt Ripper. Arthur King, Chicago, Ill.
878,643. Road Grader. Ernest Lee, Springfield, Ill.
879,386. Road Grader. Frank Hummel, Newton, Iowa.
879,805. Duplex Road Grader Drag. Geo. Alexander, State Center, Iowa.
880,312. Street or Roadway Structure. Nathaniel Lafon, Red Jacket, W. Va.
880,774. Road Grader. Lorenzo D. Baty, Knoxville, Iowa.
880,970. Road Drag. Carl J. Carlson, Wahoo, Neb.
881,027. Scraper and Grader. Oscar E. Penwell, Mountain Home, Idaho.
881,035. Method of Making a Dustless Road Surface. Benj. H. Thwaite, London, Eng.
883,332. Road Drag and Scraper. Doc McDaniel, Macon, Ill.
884,352. Road Drag. Fitch H. and Fred S. Beach, Charlotte, Mich.
884,396. Road Grader. Winfield S. Livengood, Kansas City, Mo.
884,497. Road Grader. David W. King, Maitland, Mo.
884,943. Oil Spreader. Wm. M. Murray, Sawtelle, Col.
885,984. Gasoline Road Roller. Norman De Wind and Frank R. Jones, Harvey, Ill.
886,067. Road Drag. Frank E. Ott, Indianapolis, Ind.
886,182. Road Working Machine. Wm. B. Brothers, Illiopolis, Ill.
886,802. Road Grader. Jas. T. Haynes and Herbert B. Webb, Keenes, Ill.
887,874. Street Scraper. Hugh T. Toy, Sidney, O.
888,864. Road and Process of Making Same. Bennett N. Beard, Shelton, Conn.
888,886, 888,887. Pavement and Roadway, Method of Making Same. Wm. S. Houghton, Boston, Mass.
889,692. Paving Block. Henry A. Kratzer, Clearfield, Pa.
890,110. Street Pavement. John M. Walsh, Beaumont, Tex.
890,778. Road Roller. Winfield S. Livengood, Kansas City, Mo.
890,902. Pavement and Method of Making the Same. Walter E. Hassam, Worcester, Mass.
891,569. Road Drag. Harry J. See, Deedsville, Ind.
892,320, 892,321. Portable Asphalt Plant and Mixer-Opening Device. Frank B. Smith, Philadelphia, Pa.
892,377. Cement Paving. Robert Kieserling, Altona, Germany.
892,992. Road Scraper. Frederick Heyer, Hubbard, Tex.
893,259. Road Drag. Frank E. Ott, Indianapolis, Ind.
894,269. Machine for Opening Trenches in Paved Streets. James M. Hendron, Los Angeles, Cal.
894,281. Road Machine. Thos. R. McKnight, Aurora, Ill.
894,893. Road Grader. Ernest Lee, Springfield, Ill.
895,271. Road Grading Machine. Parley J. Jewett, Butler, Mo.
895,332. Machine for Clearing Land, Roads and Streets. Julius von Bertouch, Kapunda, South Australia.
896,643. Road Sprinkling Apparatus. Bernard Kortas, Chicago, Ill.
897,080. Process for Preparing Paving or Building Blocks (from slag). Rocky C. Gangewere, South Bethlehem, Pa.
897,124. Combined Road Grader, Drag, Etc. Thos. H. Mitchell, Clayton, Ind.
898,884. Road Grader. Thompson Henry, Jamestown, Ind.
899,252. Track or Roadway (concrete). Leslie S. Hackney, St. Paul, Minn.
899,798. Road Drag. Frank E. Ott, Indianapolis, Ind.
900,369. Road Grader. Elijah A. Hollenbeck, Funk, Neb.
900,829. Road Leveler. Sylvester J. Chapman, Marietta, O.
901,569. Corrugated Metal Culvert. Clifford D. Voris, Crawfordsville, Ind.
901,702, 901,703. Culvert. Chas. E. Glasspoole, St. Paul, Minn.
901,806. Combined Road-Grader Drag and Harrow. Hamilton D. Guffey, Unionville, Mo.
902,139. Attachment for Road Machines. John T. Eady, Carrollton, Ga.
902,837. Street Paving Apparatus. Herman J. Rufli, Indianapolis, Ind.
902,885. Device for Pouring Filling Material in Crevices. Washington C. Jones, Centralia, Mo.
902,973. Method of Tunneling Under Streets, Roads, Squares, Tracks and the Like. Jesus Knudsen, Berlin, Germany.
903,162. Road Grading Machine. Simon A. D. Bertrand, Dawson, Yukon, Can.
904,106. Road Grader. Lewis E. Wild, Elmwood, Wis.
904,199, 904,200. Metal Culverts. Bernard Harris, Minneapolis, Minn.
904,586. Culvert. John F. White, Bloomington, Ill.
904,651. Culvert. Julius H. Schlafly, Canton, O.
905,073. Scraper for Road Rollers. Chas. F. Henn and David Farquhar, Buffalo, N. Y.